ISLE ROYALE NATIONAL PARK

ROCK HARBOR, MOTT ISLAND

IFB 6310-78A

UTILITIES IMPROVEMENTS

PACKAGE NOS. 179, 177, 135, 103

JULY 18, 1978

VOLUME 2

PROJECT MANUAL

National Park Service
Denver Service Center

NO DEPOSIT IS REQUIRED

FOR

DRAWINGS & SPECIFICATIONS

PLEASE RETURN TO ISSUING OFFICE

FOLLOWING OPENING OF BIDS

INDEX TO ARTICLES OF THE GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

1. Description
2. Location
3. Access
4. Layout of Work
5. **Material Source**
6. Archaeological Findings
7. Government-Furnished Items
8. Soil Information
9. Coordination
10. Maintenance of Utility Services

SECTION 01025 - FORCE ACCOUNT WORK

1. Description
2. Written Orders
3. Records
4. Payment

SECTION 01090 - ABBREVIATIONS

SECTION 01150 - DEFINITION OF BID ITEMS

SECTION 01200 - PROJECT MEETINGS

1. Preconstruction Conference
2. Construction Meetings

SECTION 01300 - SUBMITTALS

1. Submission Procedure
2. Contracting Officer's Approval
3. Shop Drawings
4. Samples
5. Certificates
6. Testing, Start-up & Operator Training
7. Progress Schedules
8. Schedule of Values
9. Review of Schedules
10. Photographs of Work

SECTION 01400 - QUALITY CONTROL

1. Construction Staking, Lines and Grades
2. Cutting and Patching

SECTION 01500 - TEMPORARY FACILITIES

1. Signs, Signals, and Barricades
2. Utilities
3. Storage Facilities
4. Sanitary Facilities
5. Field Office
6. Construction Camp
7. Safety Controls
8. Noise Control
9. Dust Control

SECTION 01560 - SPECIAL CONTROLS

1. Preservation of Natural Features
2. Housekeeping
3. Disposal of Rubbish
4. Air and Water Pollution Control
5. Fire Prevention and Protection

SECTION 01700 - PROJECT CLOSEOUT

1. Cleaning
2. Project Record Drawings
3. Substantial Completion and Final Inspection
4. Acceptance of the Work
5. Operating Instructions
6. Closeout Submittals
7. Post-Construction Inspection

END

1. DESCRIPTION:

MOTT ISLAND FUEL STORAGE - IMPROVEMENT B: The principal features of this work include the construction of fuel storage and distribution facilities comprising a spill retainment concrete tank containing two 20,000 gallon diesel fuel tanks, one 20,000 gallon gasoline tank and one 5,000 gallon aviation gasoline tank; and all the related controls, appurtenances and miscellaneous facilities, including valves, distribution piping, dispensing pumps, metering, alarms and fencing. Work includes removal of six existing fuel storage tanks for reuse or salvage and three tanks to be abandoned.

ROCK HARBOR FUEL STORAGE - IMPROVEMENT C: The principal features of this work include the construction of fuel storage and distribution facilities comprising a spill retainment concrete tank containing one 20,000 gallon gasoline tank, one 10,000 gallon diesel fuel tank, and one 1,500 gallon diesel fuel tank; and all the related controls, appurtenances and miscellaneous facilities, including day tanks, valves, distribution piping, dispensing pumps, metering and alarms. Work includes the removal of five existing fuel storage tanks for reuse or salvage.

ROCK HARBOR WATER - IMPROVEMENT D: The principal features of this work include construction of a lake water intake and raw water pumps, solid contact unit with mixers, rapid sand filters, transfer pumps, water storage tanks, high service and backwash pumps, hydro-pneumatic tank system, wastewater tank, wastewater pumps, appropriate piping, chemical feed systems, water treatment plant building, all related metering, controls, electrical services and support construction such as roads, foundations, fencing, and the removal of existing water pipe where shown on the Contract Drawings.

ROCK HARBOR BOAT PUMP-OUT SYSTEM - IMPROVEMENT E: The principal features of this work include installation of a boat pump-out system including sewer, water and electric line installation.

All work for the four improvements will be performed under a single contract.

2. LOCATION: The project is located in its entirety at the Isle Royale National Park which lies on a southwest-northeast bearing in the northwest portion of Lake Superior, about 14 miles from the Minnesota and Canadian mainland at its closest point. The Park occupies a portion of Eagle Harbor and Houghton Townships, Keweenaw County, Michigan. The land mass of the Park is between Section 9, T63N, R39W, at the southwest and Section 3, T67N, R32W on the northeast. The Park lies between 80° 15' W and 89° 20' W longitude and 47° 44' N and 48° 16' N latitude.

MOTT ISLAND FUEL STORAGE - IMPROVEMENT B: This portion of the project is located in vicinity of the Park Headquarters, at Mott Island. Mott Island is located about 8 miles southwest of the extreme northeast side of Isle Royale. The improvement site is located in Houghton Township, in Section 13, T66N, R34W, and Section 18, T66N, R33W. Mott Island is approximately 70 miles from Houghton, Michigan.

ROCK HARBOR FUEL STORAGE - IMPROVEMENT C, AND ROCK HARBOR WATER SYSTEM - IMPROVEMENT D: This portion of the project is located at the Rock Harbor developed area, approximately 4 miles southwest of the extreme northeast side of Isle Royale and about 4 miles northeast of the Park Headquarters. The improvement sites are located in Houghton Township, in Section 4, T66N, R33W. The Rock Harbor Area is approximately 70 miles from Houghton, Michigan.

3. ACCESS:

A. General: Due to the remote location of the project, transportation of all construction materials, equipment and personnel to Isle Royale must be by either air or water vehicles.

B. Hauling Restrictions: Comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the project. Load restrictions on park roads are identical to the state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. Existing roadways to the construction sites are very limited and consist of gravel roads and paths and some asphalt pathways. A special permit will not relieve Contractor of liability for damage which may result from the moving of equipment.

C. Waterways Navigation: Only access to the project sites and between sites is by water or air. The operation of all boats, ships, barges, tugs and seaplanes shall comply with all Local, State and Federal laws which apply to such vehicles used on this project.

D. Airways: Isle Royale is designated a National Wilderness area, except for the developed areas at the project site and as such all air space restrictions shall be complied with in any flights related to this project.

E. Pre-bid Site Visit: Arrangements for pre-bid site visits to the construction sites by potential bidders should be made with the Park Superintendent. The Government has available at Houghton, Michigan, charter seaplane service to the Park. Information regarding the cost and scheduling of this seaplane service may be obtained from the Park Superintendent.

F. Special Limitations: Time limitations and locations at the park for hauling routes and unloading stations for materials and equipment will be designated by the Park Superintendent.

4. LAYOUT OF WORK:

A. Contracting Officer will set a base line and bench mark for each area of the work. Contractor shall lay out the work by accurately measuring from these controls. All work improperly located due to Contractor's errors or omissions shall be corrected by him at no additional expense to the Government.

B. Contractor shall preserve controls thus established. Controls originally set by Contracting Officer which are destroyed by Contractor will be replaced by Contracting Officer, with the cost of replacement deducted from Contractor's final payment.

C. Locations and elevations indicated on the drawings are subject to final field adjustment by Contracting Officer prior to construction. Contractor shall immediately notify the Contracting Officer of apparent errors discovered on the drawings or in the initial stakeout. If changes in stakeout are required, Contractor shall cooperate with Contracting Officer in prompt establishment of the field control for altered or adjusted work.

D. Existing Monuments: All bench marks, land corners, and triangulation points, established by other surveys, existing within the construction area shall be preserved. If existing monuments interfere with the work, secure written permission before removing them.

5. MATERIAL SOURCE: All borrow material, base course, surfacing and concrete aggregates, and chips shall be Contractor-furnished from sources outside the park boundary. Comply with applicable state and local laws.

6. ARCHEOLOGICAL FINDINGS: There are no know archeological remains in the work area. Should any skeletons, artifacts, or other archeological remains be uncovered, Contractor shall suspend operations at the site of discovery; notify Contracting Officer immediately of the findings; and continue operations in other areas. Included with the notification shall be a brief statement of the location and details of the findings. Should the temporary suspension of the work at the site result in delays, or the discovery site require archeological studies resulting in delays or additional work for Contractor, he will be compensated by an equitable adjustment under the General Provisions of the Contract.

7. GOVERNMENT-FURNISHED ITEMS: The following items will be furnished by the Government. The Contractor is responsible for removing these items from their existing locations and installing them as shown on the drawings.

A. 10,000-gallon diesel fuel tank at the Deep Water Dock, Mott Island, to be relocated at the Wastewater Treatment Plant, Rock Harbor, for future use.

B. 1,500-gallon diesel fuel tank located at the incinerator, Rock Harbor, to be relocated at the new fuel storage site, Rock Harbor.

C. 2-gasoline dispensing pumps, located at the small craft portion of the Deep Water Dock, Mott Island, to be relocated as follows: 1 pump at the small craft dock and 1 pump near the generator building, Mott Island.

8. SOIL INFORMATION: A soil investigation report for the project site is available at Park Headquarters, Houghton, Michigan.

9. COORDINATION: The coordination of all work must be done in such a manner so as to minimize the interruption of existing park operations and services, including existing utility services. The Contractor is required to notify the Park Superintendent a minimum of 24 hours in advance prior to any interruption in existing park operations or utility services and shall schedule such interruptions at periods in the day acceptable to the Park Superintendent. The Contractor shall not obstruct the use of Park facilities used by Park visitors without receiving permission from the Contracting Officer prior to such obstructions.

10. MAINTENANCE OF UTILITY SERVICES:

A. Mott Island Fuel Storage - Improvement B: Time limitations on the interruption of existing utility services during construction will be one hour for electrical service; four hours for all gasoline, diesel and aviation fuel dispensing pumps; 24 hours for the incinerator; and no interruption allowed for generator service at the Power House. Extensions of the time limitations specified herein will not be allowed except in the case where prior approval has been given by the Contracting Officer.

B. Rock Harbor Fuel Storage - Improvement C: Time limitations on the interruption of existing utility services during construction will be one hour for electrical service; four hours for gasoline and diesel fuel dispensing pumps; four hours for the diesel fuel supply to Lodge No. 1 and Lodge No. 2; and 24 hours for the incinerator. Extensions of the time limitations specified herein will not be allowed except in the case where prior approval has been given by the Contracting Officer.

C. Rock Harbor Water System - Improvement D: Time limitations on the interruption of existing utility services during construction will be one hour for electrical service; two hours for water service and no interruption allowed for sanitary sewer service. Extensions of the time limitations specified herein will not be allowed except in the case where prior approval has been given by the Contracting Officer.

D. Rock Harbor Boat Pump-Out System: Time limitations for interruptions of utilities shall be limited to 4 hours.

END

1. DESCRIPTION: The intent of this section is to provide miscellaneous materials, labor, and equipment of minor nature necessary for the work and for which no specific bid item exists in the Contract Bid Schedule.

2. WRITTEN ORDERS: No work shall be done under this section until a written order is received by Contractor. Any request for an order after unauthorized work has been performed will be denied.

3. RECORDS: Contractor shall furnish cost invoices, including delivery cost, for all materials and supplies provided under this section. At the end of each day, Contractor and Contracting Officer shall compare and sign, in duplicate, records of all work performed on a force account basis with each retaining a copy.

4. PAYMENT: Payment for this work shall be in accordance with Clause 3 "Changes" of the General Provisions.

END

1. The following abbreviations are used throughout these specifications:

A.P.I. - American Petroleum Institute
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
cfs - cubic feet per second
ea. - each
gpm - gallons per minute
in. - inches
L.F. - Linear Feet
L.S. - Lump Sum
MDSH&T - Michigan Department of State Highways and Transportation
N.E.C. - National Electric Code
N.F.P.A. - National Fire Protection Association
N.S.F. - National Sanitation Foundation
U.B.C. - Uniform Building Code
U.P.C. - Uniform Plumbing Code
A.A.S.H.T.O. - American Association of State Highway and Transportation Officials

END

Item 1 - FORCE ACCOUNT WORK: See Section 01025.

IMPROVEMENT B: MOTT ISLAND FUEL STORAGE

Item 2 - CLEARING AND GRUBBING

A. Description: This item consists of all clearing, tree removal, and tree pruning, in the storage site and the surrounding clear zone as shown on the drawings and as specified.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 3 - DEMOLITION

A. Description: This item consists of the removal of existing tanks and their foundations, backfilling of related excavations, with approved materials filling the buried gasoline tanks with grout and preparing them for abandonment, and removal of all other facilities indicated on the drawings as specified. Also included in this item is the transportation of a 10,000 gallon tank to Rock Harbor at the sewage treatment plant site for future Government use.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 4 - EARTHWORK AND EXCAVATION

A. Description: This item consists of topsoil stripping and replacement, grading, foundation excavation and subgrade preparation related to the construction of the storage facility.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 5* - STORAGE TANKS, NEW 20,000 GALLON TANK

A. Description: This item of work includes the furnishing and installation of new 20,000 storage tanks, including construction of the concrete foundations, saddle supports, access manholes and covers, pipe openings, ladders, and tank vents, as shown on the drawings and as specified.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of 20,000 gallon tank units installed. Quantities so measured will be paid for at the contract unit price.

Item 6* - STORAGE TANKS, NEW 5,000 GALLON TANK

A. Description: This item of work includes the furnishing and installation of a new 5,000 gallon aviation fuel tank, including construction of the concrete foundation, saddle supports, access manholes and cover, pipe openings, ladders, and tank vents, as shown on the drawings and as specified.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of tank units installed. Quantities so measured will be paid for at the contract unit price.

*See note at the end of section.

Item 7 - SECONDARY CONTAINMENT

A. Description: This item of work consists of the construction of the concrete containment structure, as shown on the drawings, including formwork, reinforcing steel, concrete work, expansion and contraction joints, sealing and leakproofing, and fence construction.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 8 - PIPING, 3 INCH GALVANIZED STEEL PIPE

A. Description: This item of work consists of the installation of all new 3 inch galvanized steel pipe, fittings and valves where shown on the drawings and specified in the specifications. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 17, 18 and 19 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 3 inch galvanized steel pipe, fittings and valves constructed and measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

Item 9 - PIPING 2 INCH GALVANIZED STEEL PIPE

A. Description: This item of work consists of the installation of all new 2 inch galvanized steel pipe, fittings and valves including gasoline intake port as shown on the drawings and specified in the specifications. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 17, 18 and 19 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 2 inch galvanized steel pipe, fittings and valves constructed and measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

Item 10 - PIPING 2 INCH FIBERGLASS PIPE

A. Description: This item of work consists of the installation of all new 2 inch fiberglass pipe, fittings and valves as shown on the drawings and specified in the specifications. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 17, 18 and 19 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 2 inch fiberglass pipe, fittings and valves constructed and measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

Item 11 - PIPING 1 INCH GALVANIZED STEEL PIPE

A. Description: This item of work consists of the installation of all new 1 inch galvanized steel pipe, fittings and valves as shown on the drawings and specified in the specification. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 17, 18 and 19 (Class A1, A2 & B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 1 inch galvanized steel pipe, fittings and valves constructed and measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

Item 12 - DISPENSING PUMPS, RELOCATE EXISTING PUMPS

A. Description: This item of work consists of removal of the existing dispensing pumps and appurtenances, reconditioning or replacing any pump seals, meter seals found to be leaking or damaged and reinstalling the units with new safety valves as shown on the drawings and specified in the specifications.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of dispensing pump units relocated. Quantities so measured will be paid for at the contract unit price.

Item 13 - DISPENSING PUMPS: NEW PUMPS

A. Description: This item of work consists of supplying and installing the new dispensing pumps and safety valves as shown on the drawings and specified in the specifications.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of dispensing pumps and safety valve units installed. Quantities so measured will be paid for at the contract unit price.

Item 14 - METERING AND ALARMS

A. Description: This item of work consists of supplying and installing the fuel system controls, alarms including transmitters, remote indicators and float switches as shown on the drawings and specified in the specifications.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 15 - ELECTRICAL WORK

A. Description: This item of work consists of supplying and installing the electrical switches, panel boxes, relays, wires and conduit shown on the drawings and specified in the specifications to connect the fuel dispensing pumps, fuel tank filling systems but not to supply the meters or alarms.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump price.

Item 16 - FENCING

A. Description: This item of work consists of supplying and installing the 6' foot high vinyl clad galvanized steel chain link fence and gates as shown on the drawings and specified in the specifications.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of fencing constructed and measured at the centerline of the fence. Quantities so measured will be paid for at the contract unit price.

Item 17 - CLASS A1 PIPE CONCEALMENT

A. Description: This item of work consists of the Class A1 pipe concealment in bedrock including jackhammering of rock, sand bedding, excavation and backfilling, and replacement of all gravel and paved trail crossings as shown on the Contract Drawings and as specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of Class A1 pipe concealment constructed, measured at the centerline of the pipe. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 18 - CLASS A2 PIPE CONCEALMENT

A. Description: This item of work consists of the Class A2 pipe concealment in fragmented rock including sand bedding, excavation and backfilling, and replacement of all gravel and paved trail crossings as shown in the Contract Drawings and specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The_unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of Class A2 pipe concealment constructed and measured at the centerline of the pipe. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 19 - CLASS B PIPE CONCEALMENT

A. Description: This item of work consists of the Class B pipe concealment including sand bedding, concealment materials, and replacement of all gravel and paved trail crossings as shown on the detail drawings and specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of Class B pipe concealment constructed and measured at the centerline of the pipe. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

IMPROVEMENT C: ROCK HARBOR FUEL STORAGE

Item 20 - CLEARING AND GRUBBING

A. Description: This item consists of all clearing, tree removal and tree pruning, in the storage site and the surrounding clear zone as shown on the drawings and as specified.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 21 - DEMOLITION

A. Description: This item consists of the removal of existing tanks and their foundations, backfilling of related excavations with approved materials and removal of all other facilities indicated on the drawings and as specified in the specifications. Also included in this item is the transportation of a 1,500 gallon tank for reuse at the fuel storage site.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 22 - EARTHWORK AND EXCAVATION

A. Description: This item consists of topsoil stripping and replacement, grading, foundation excavation and subgrade preparation related to the construction of the storage facility.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 23* - STORAGE TANK, NEW 20,000 GALLON TANK DIESEL

A. Description: This item of work includes the furnishing and installation of a new 20,000 gallon storage tank, including construction of the concrete foundations and saddle supports, access manhole and cover, pipe openings, ladder, and tank vents, as shown on the drawings and as specified in the specifications.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of 20,000 gallon tank units installed. Quantities so measured will be paid for at the contract unit price.

Item 24* - STORAGE TANKS NEW 10,000 GALLON TANK

A. Description: This item of work includes the furnishing and installation of a 10,000 gallon diesel fuel tank including construction of the concrete foundation, saddle supports, access manholes and covers, pipe openings, ladders and tank vents as shown on the drawings and as specified.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of 10,000 gallon existing tank units installed. Quantities so measured will be paid for at the contract unit price.

Item 25 - STORAGE TANK EXISTING 1,500 GALLON DIESEL FUEL

A. Description: This item of work consists of reconditioning, refitting, and installation of a 1,500 gallon diesel fuel tank with access manhole and cover, ladder and tank vents as shown on the drawings and specified in the specifications.

*See note at the end of section.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of 1,500 gallon existing tank units installed. Quantities so measured will be paid for at the contract unit price.

Item 26* - STORAGE TANKS NEW 270 GALLON DAY TANK

A. Description: This item of work consists of installing three (3) - 270 gallon day tanks with supports as shown on the drawings and as specified in the specifications.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of 270 gallon tank units installed. Quantities so measured will be paid for at the contract unit price.

Item 27 - SECONDARY CONTAINMENT

A. Description: This item of work consists of the construction of the concrete containment structure, as shown on the drawings, including formwork, reinforcing steel, concrete work, expansion and contraction joints, sealing and leakproofing, as shown on the drawings and specified in the specifications.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 28 - PIPING: 2-1/2 INCH GALVANIZED STEEL PIPE

A. Description: This item of work consists of the installation of all new 2-1/2 inch galvanized steel pipe, fittings and valves where shown on the drawings and specified in the specifications. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 34, 35 and 36 (Class A1, A2 & B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be linear foot. Measurement will be the actual number of linear feet of 2-1/2 inch galvanized steel pipe fittings and valves constructed and measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

*See note at the end of section.

Item 29 - PIPING 2 INCH GALVANIZED STEEL PIPE

A. Description: This item of work consists of the installation of all new 2 inch galvanized steel pipe, fittings and valves as shown on the drawings and specified in the specifications. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 34, 35 and 36 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 2 inch galvanized steel pipe, fittings and valves measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

Item 30 - PIPING 1 INCH GALVANIZED STEEL PIPE

A. Description: This item of work consists of the installation of all new 1 inch galvanized steel pipe, fittings and valves as shown on the drawings and specified in the specifications. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 34, 35 and 36 (Class A1, A2 & B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 1 inch galvanized steel pipe, fittings and valves constructed and measured at the centerline of the pipe. Quantities so measured will be paid for at the contract unit price.

Item 31 - DISPENSING PUMPS: NEW PUMPS

A. Description: This item of work consists of supplying and installing the new dispensing pump and safety valve as shown on the drawings and specified in the specificaions.

B. Measurement and Payment: The unit of measurement for payment will be each. Measurement will be the actual number of dispensing pumps and safety valve units installed. Quantities so measured will be paid for at the contract unit price.

Item 32 - METERING AND ALARMS

A. Description: This item of work consists of supplying and installing the fuel system controls, alarms including transmitters, remote indicators and float switches as shown on the drawings and specified in the specifications.

B. Measurement and Payment: No measurement will be made for ths work. Payment for all work included will be at the contract lump sum price.

Item 33 - ELECTRICAL WORK

A. Description: This item of work consists of supplying and installing the electrical switches, panel boxes, relays, wires and conduit shown in the drawings and specified in the specifications to connect the fuel dispensing pumps, fuel tank filling systems but not to supply the meters or alarms.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 34 - CLASS A1 PIPE CONCEALMENT

A. Description: This item of work consists of the Class A1 pipe concealment in bedrock including jackhammering of rock, sand bedding, excavation and backfilling and replacement of all gravel and paved trail crossings as shown in the Contract Drawings and as specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be linear foot. Measurement will be the actual number of linear feet of Class A1 pipe concealment constructed and measured at the centerline of the pipe. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 35 - CLASS A2 PIPE CONCEALMENT

A. Description: This item of work consists of the Class A2 pipe concealment in fragmented rock including sand bedding, excavation and backfilling and replacement of all gravel and paved trail crossings as shown in the Contract Drawings and specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of Class A2 pipe concealment constructed and measured at the centerline of the pipe. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 36 - CLASS B PIPE CONCEALMENT

A. Description: This item of work consists of the Class B pipe concealment including sand bedding, concealment materials and replacement of all gravel and paved trail crossings as shown on the detail drawings and specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of Class B pipe concealment constructed and measured at the centerline of the pipe. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 37 - CLEARING AND GRUBBING

A. Description: This item includes all clearing, tree removal and tree pruning associated with preparing the water treatment and storage facilities site and the access road for construction, as specified and shown on the drawings.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 38 - DEMOLITION

A. Description: This item includes the disconnection of existing raw water and distribution system piping and of piping at the elevated water tank as shown on the Contract Drawings. Not included in this item is the demolition and removal of the existing raw water pumphouse and elevated storage tank.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 39 - EARTHWORK AND EXCAVATION

A. Description: This item includes topsoil stripping, grading, foundation excavation, rock removal and subgrade preparation related to the construction of the water treatment and water storage facilities and the access road.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 40* - RAW WATER SUPPLY, WATER INTAKE

A. Description: This item includes the furnishing and installation of the intake structure and intake pipe, including the intake screen, submerged buoy, all concrete anchors, concrete encasement of the intake pipe, rip-rap concealment materials, air tubing and screen backwash pipe connection fittings, and all related accessories as shown on the Contract Drawings. Not included in this item is the inline submersible pumps and related accessories.

*See note at the end of section.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 41 - RAW WATER SUPPLY, SUBMERSIBLE PUMPS

A. Description: This item includes the furnishing and installation of two inline submersible pumps as shown on the Contract Drawings, including the pump and motor assemblies, column pipes, discharge head assemblies, all the pipe and tube fittings between the water intake system and the outside wall of the drain pit on the side closest to the Dining Hall, the drain pit itself, and all associated electrical equipment, between the submersible pumps and the outside wall of the Control Building.

B. Measurement and Payment: No measurement will be for this work. Payment for all work included will be at the contract lump sum price.

Item 42 - RAW WATER SUPPLY, 4" D.I. PIPE

A. Description: This item includes the furnishing and installation of a new 4" diameter ductile iron pipe starting from a point just outside the drain pit on the side closest to the Dining Hall and ending at the fence line of the water treatment and storage facilities site. Included in this item are all pipe fittings and valves, the 3/4" polyethylene tubing installed inside of the 4" ductile pipe and tubing pull boxes. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 53, 54 and 55 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 4" ductile iron pipe constructed, measured at the centerline of the the 4" ductile iron pipe. Quantities so measured will be paid for at the contract unit price.

Item 43 - WATER TREATMENT PLANT

A. Description: This item includes furnishing materials, equipment and labor necessary to construct the water treatment plant which includes the Control Building and all of its contents ending at the outside wall of the building, and all water treatment process equipment, both inside and outside of the building. Also included in this item is the extension of electrical service from an existing power line to the building as shown on the Contract Drawings. A description of this bid item is given below:

a.* Process Equipment:

Included in the process equipment are: chemical feed system, including feed pumps, solution tanks, feed lines and process chemicals; all treatment units and accessories, including, rapid mix units or inline static mixers, flocculation and settling equipment (e.g., solids contact unit), rapid sand filtration equipment, transfer pumping units, filter backwash supply pumps, and backwash waste and sludge pumping units.

b. Lab and Office Furnishings:

Included in lab and office furnishings are: a clothes closet; a laboratory stool; base and wall cabinets and counter tops with premounted sinks; safety eye wash and shower equipment; equipment to test coliform bacteria by membrane filter technique; jar test equipment; kit to test chlorine, magnesium, calcium, hardness, and alkalinity; pH meter; and a turbidity meter with a continuous recorder and alarm.

c.* High Service Pumping Unit:

Included in the high service pumping unit are: the high service pumps with associated valves and electrical controls; and all the equipment and controls inside the building associated with the hydro-pneumatic system, including the air compressor system.

d. Control Building Structural:

Included in the control building structural is all the architectural and structural work associated with the Control Building, including shelving and wood platforms and stairways.

e. Control Building Mechanical:

Included in the control building mechanical are: architectural mechanical work; and the equipment mechanical not included in "a" through "d" as given above, including flow meters, pressure gauges, and other miscellaneous mechanical work.

f. Control Building Electrical: Included in the control building electrical are:the electrical service equipment; the control panel; architectural electrical work; and all the associated equipment electrical as required.

*See note at the end of section.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included in Bid Item 43 a - f will be at the contract lump sum price.

Item 44 - YARD PIPING

A. Description: This item includes furnishing materials, equipment and labor to construct all yard piping located inside the fenceline of the water treatment and storage facilities site, with the exception of any piping and mechanical work defined in Items 43, 45, 46, 47, 48 and 49. Unless shown otherwise on the Contract Drawings, all yard piping is to be installed above final grade. Included in yard piping, is all the associated pipe fittings and valves.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 45* - WASTE SYSTEM, NEW 1,500 GALLON WASTE TANK

A. Description: This item includes the furnishing and installation of a 1,500 gallon storage tank as shown on the Contract Drawings with all the associated tank foundations and supports, access openings, vents and ladders, and all related piping, valving and electrical work going to and from the tank, starting at the outside wall of the Control Building and ending at the tank itself.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 46 - WASTE SYSTEM, 6" D.I. PIPE

A. Description: This item includes the furnishing and installation of a new 6" diameter ductile iron pipe starting at the outside wall of the Control Building and ending after the connection fitting to the existing sewage surge tank, as shown on the Contract Drawings. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 53, 54 and 55 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

*See note at the end of section.

B. Measurement and Payment: The unit of measurement will be the linear foot. Measurement will be the actual number of linear feet of 6" ductile iron pipe constructed, measured at the centerline of the 6" ductile iron pipe. Quantities so measured will be paid for at the contract unit price.

Item 47 - WASTE SYSTEM, 1-1/2" GALVANIZED STEEL PIPE

A. Description: This item includes the furnishing and installation of a new 1-1/2" diameter galvanized steel pipe starting at the outside wall of the Control Building and ending after the connection fitting to the existing sewage surge tank, as shown on the Contract Drawings. Excavation and backfill associated with the installation of this pipe is not included in this bid item, but is included instead in Items 53, 54 and 55 (Class A1, A2 and B Pipe Concealment) as a separate pay item.

B. Measurement and Payment: The unit of measurement for payment will be linear foot. Measurement will be the actual number of linear feet of 1-1/2" galvanized steel pipe constructed, measured at the centerline of the 1-1/2" polyethylene pipe. Quantities so measured will be paid for at the contract unit price.

Item 48* - WATER STORAGE FACILITIES

A. Description: This item includes the furnishing and installation of the water storage tanks as shown on the Contract Drawings and as specified including tank foundations and supports, access openings, vents, ladders, and all related piping, valving and electrical work going to and from the tanks, starting at the outside wall of the Control Building and ending at the tanks.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 49* - HYDRO-PNEUMATIC TANK

A. Description: This item includes the furnishing and installation of the hydro-pneumatic tank with tank foundations, support ladders, access openings, vents, and all the piping, valves, tubing, and electrical work going from the outside wall of the Control Building to the tank and continuing on to the connection point to the existing 4" diameter G.S. water main pipe.

*See note at the end of section.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 50 - BITUMINOUS SURFACING, ACCESS ROAD

A. Description: This item includes furnishing material and labor necessary to construct the bituminous concrete access road, as shown on the Contract Drawings. Excluded from this item are the earthwork, subgrade preparation, and clearing and grubbing.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of access road constructed and measured at the centerline of the road. Quantities so measured will be paid for at the contract unit price.

Item 51 - BITUMINOUS SURFACING, PARKING AREA

A. Description: This item includes furnishing materials and labor necessary to construct the bituminous concrete parking area at the water treatment and storage facilities site, as shown on the Contract Drawings. Excluded from this item are the earthwork, subgrade preparation, and clearing and grubbing.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 52 - FENCING

A. Description: This item includes the furnishing and installation of 6' foot high galvanized steel chain link fencing and gates as shown on the plans.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of fencing constructed, measured at the centerline of the fence. Quantities so measured will be paid for at the contract unit price.

Item 53 - CLASS A1 PIPE CONCEALMENT

A. Description: This item of work consists of the Class A1 pipe concealment in bedrock including jackhammering of rock, sand bedding excavation and backfilling, and replacement of all gravel and paved trail crossings as shown on the Contract Drawings and as specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of pipeline concealed, measured at the centerline of the pipe being concealed. In the case where two or more adjacent pipes are to be concealed together, as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 54 - CLASS A2 PIPE CONCEALMENT

A. Description: This item of work consists of the Class A2 pipe concealment in fragmented rock including sand bedding, excavation and backfilling, and replacement of all gravel and paved trail crossings as shown on the Contract Drawings and specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of pipeline concealed, measured at the centerline of the pipe being concealed. In the case where two or more adjacent pipes are to be concealed together, as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 55 - CLASS B PIPE CONCEALMENT

A. Description: This item of work consists of the Class B pipe concealment including sand bedding, concealment materials, and replacement of all gravel and paved trail crossings as shown on the detail drawings and specified in the specifications and as directed by the Contracting Officer.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of pipeline concealed, measured at the centerline of the pipe being concealed. In the case where two or more pipes are to be concealed together as directed by the Contracting Officer, payment for this bid item will be on the basis of the linear feet measured for only one of the pipes concealed. In the case where a combination of two or more different class concealments are made, payment will be made for the class type that consists of greater than 50 percent of the total concealment depth. Concealment depth is the distance from the top of final grade to the bottom of sand bedding. Quantities so measured will be paid for at the contract unit price.

Item 56 - BOAT PUMP-OUT STATION

A. Description: This item includes the furnishing and installation of the marine holding tank pump-out station and all valves, piping, and appurtenances within 5 feet of the pump-out station. Also included is all electrical work to operate the system as shown on the drawings.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

Item 57 - 2-INCH GALVANIZED STEEL PIPE

A. Description: This item includes the furnishing and installation of 2-inch galvanized steel pipe from the boat pump-out station to the new sewer connection manhole as shown on the drawing.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 2-inch galvanized steel pipe and quantities so measured will be paid for at the contract unit price.

Item 58 - 1-INCH GALVANIZED STEEL PIPE

A. Description: This item includes the furnishing and installing of 1-inch galvanized steel pipe from the boat pump-out station to a tap on the existing water main as shown on the drawings.

B. Measurement and Payment: The unit of measurement for payment will be the linear foot. Measurement will be the actual number of linear feet of 1-inch galvanized steel pipe actually installed. Quantities so measured will be paid for at the contract unit price.

Item 59 - MANHOLE

A. Description: This item includes the furnishing and installation of a manhole to tie the boat pump-out station to the existing sewer system as shown on the drawing. Removing the existing cleanout, tying in of all required sewer lines and installation of all pipe within 5 feet of the manhole shall be included in this item.

B. Measurement and Payment: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price.

*Note: On the bid items listed below, it is highly recommended that all or a portion of the equipment specified be pre-assembled and skid mounted where appropriate (including painting and finishing) at the factory or at the Contractor's shop prior to the shipment of these materials to the project site: Items 5, 6, 23, 24, 26, 40 (intake structure and concrete anchor collars), 43a, 43c, 45, 48 and 49.

END

1. PRECONSTRUCTION CONFERENCE: As soon as possible after issuance of Notice to Proceed and prior to start of construction, Contracting Officer will arrange an on-site meeting with Contractor. The meeting agenda will include the following:

Correspondence procedures
Designation of responsible personnel
Labor standards provisions
Payroll reports
Changes
Payments to Contractor
Subcontractors
National Park Service regulations
Accident prevention
Tentative construction schedule
Submittal of shop drawings, project data and samples

2. CONSTRUCTION MEETINGS: The Contracting Officer reserves the right to schedule construction meetings with the Contractor during construction, to review progress or for other reasons deemed necessary by the Contracting Officer.

END

1. SUBMISSION PROCEDURE: At least two weeks before Contractor's need for approval, submit 6 copies or 6 specimens (unless a different number is specified in the individual section) of all submittals required under this section to Contracting Officer. Identify all submittals on National Park Service form DSC-1(CS). When approved, one copy will be returned to Contractor. The listing of submittals given below is intended to be as complete as possible. However, Contracting Officer reserves the right to request additional submittals. No materials requiring Contracting Officer's approval shall be delivered to the site until approval has been given.

2. CONTRACTING OFFICER'S APPROVAL: Contracting Officer will indicate his type of review of the submittals and if they are not acceptable as submitted the Contracting Officer will indicate the reasons therefore. Any work done prior to such review shall be at Contractor's risk.

3. SHOP DRAWINGS:

A. Definition: The term "shop drawings" includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by Contractor to explain in detail specific portions of the work required by the Contract. Such submittals shall include wiring diagrams, electrical schematics, and operating sequences.

B. Contractor's Review and Approval: Contractor shall coordinate all such drawings, and review them for accuracy, completeness and compliance with contract requirements and shall indicate his approval thereon as evidence of such coordination and review. Shop drawings submitted to Contracting Officer without evidence of Contractor's approval may be returned for resubmission.

C. Approval by Contracting Officer: Such review shall not relieve Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this Contract, except with respect to variations described and approved in accordance with Paragraph D below.

D. If shop drawings show variations from the contract requirements, Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If Contracting Officer approved any such variation(s), he shall issue an appropriate Contract modification, except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued.

E. SHOP DRAWINGS REQUIRED:

Division or Section	Description
Mott Island Fuel Storage - Improvement B:	
Sec. 02710	Fences & Gates
Sec. 15080	Pipe Specialties
Sec. 15100	Valves, Cocks and Faucets
Sec. 16100	Basic Materials
Sec. 16134	Panelboards
Sec. 16900	Controls, Instrumentation and Alarms
Rock Harbor Fuel Storage - Improvement C:	
Sec. 15080	Pipe Specialties
Sec. 15100	Valves, Cocks and Faucets
Sec. 16100	Basic Materials
Sec. 16134	Panelboards
Sec. 16900	Controls, Instrumentation and Alarms
Rock Harbor Water System - Improvement D:	
Sec. 02710	Fences and Gates
Sec. 05120	Structural Steel
Sec. 05520	Handrail and Railings
Sec. 07601	Flashing and Sheet Metal
Sec. 08110	Hollow Metal Doors and Frames
Sec. 08610	Wood Windows
Sec. 08710	Finish Hardware

Rock Harbor Water System - Improvement D: (continued)

Division or Section	Description
Sec. 10200	Louvers and Vents
Sec. 10800	Toilet and Bath Accessories
Sec. 15080	Pipe Specialties
Sec. 15100	Valves, Cocks and Faucets
Sec. 15231	Hydro-Pneumatic Systems
Sec. 15400	Plumbing
Sec. 15450	Plumbing Fixtures and Trim
Sec. 15540	Portable Extinguishers
Sec. 15829	Exhaust Fan
Sec. 15840	Ductwork
Sec. 16100	Basic Materials
Sec. 16134	Panelboards
Sec. 16510	Lighting Fixtures
Sec. 16900	Controls, Instrumentation and Alarms
Sec. 16930	Lighting Control Equipment

Rock Harbor Pump-Out System

Sec. 15141	Boat Pump-Out Station

4. SAMPLES Samples Required:

Mott Island Fuel Storage - Improvement B:

Sec. 09901	Painting and Other Finishes

Rock Harbor Fuel Storage - Improvement C:

Sec. 09901	Painting and Other Finishes

Rock Harbor Water System - Improvement D:

Sec. 06200	Finish Carpentry
Sec. 07330	Cedar Shake Roofs
Sec. 08840	Glazing Plastics
Sec. 09901	Painting and Other Finishes

5. CERTIFICATES: For those items listed below, furnish certificates from manufacturers, suppliers, or others certifying that materials or equipment to be furnished under the Contract comply with the requirements of these specifications.

Division or Sections	Description
Mott Island Fuel Storage - Improvement B:	
Sec. 02820	Fertilizing and Mulching
Sec. 03210	Concrete Reinforcing Steel
Sec. 03300	Cast-in-Place Concrete - Cement and Test Cylinders
Sec. 07150	Dampproofing
Sec. 07951	Sealants and Caulking
Sec. 15010	Air Balance Tests
Sec. 15140	Pumps
Sec. 15170	Meters and Gauges
Rock Harbor Fuel Storage - Improvement C:	
Sec. 02820	Fertilizing and Mulching
Sec. 03210	Concrete Reinforcing
Sec. 03300	Cast-in-Place Concrete - Cement and Test Cylinders
Sec. 07150	Dampproofing
Sec. 07951	Sealants and Caulking
Sec. 15140	Pumps
Sec. 15170	Meters and Gauges
Rock Harbor Water System - Improvement D:	
Sec. 02820	Fertilizing and Mulching
Sec. 03210	Concrete Reinforcing

Rock Harbor Water System - Improvement D: (continued)

Division or Sections	Description
Sec. 03300	Cast-in-Place Concrete - Cement and Test Cylinders
Sec. 04100	Mortar
Sec. 04220	Concrete Unit Masonry
Sec. 07150	Dampproofing
Sec. 07951	Sealants and Caulking
Sec. 15140	Pumps
Sec. 15170	Meters and Gauges
Sec. 15540	Portable Extinguishers

6. TESTING, START-UP AND OPERATOR TRAINING: The Contractor shall submit to the Contracting Officer satisfactory evidence that the equipment listed below will be furnished by a Manufacturer with an established service support program with qualified personnel readily available to test this equipment, to provide maintenance when needed, and to assist the Government in system start-up operations and Government operator training; and the equipment is such that spare parts are kept in stock and are available in the area of the installation. The required duration of instruction for operator training is specified below. Testing and start-up procedures shall be completed and the equipment must be operational prior to the initiation of operator training. In addition, the Contractor shall submit to the Contracting Officer written certification by the manufacturer's representative, that the equipment listed below was installed, inspected, and tested, and operated as instructed and satisfactorily performed as intended.

Bid Item(s)	Description	Minimum Duration of Operator Training (hours)
14 & 15	Mott Island Fuel Storage Improvement B, Metering and Alarms and Electrical Work	8
32 & 33	Rock Harbor Fuel Storage Improvement C, Metering and Alarms and Electrical Work	8
43(a)	Rock Harbor Water System-Improvement D, (a) Process Equipment	32
43(f) & 49	Rock Harbor Water System-Improvement D, (f) Control Building Electrical and Hydro-Pneumatic Tank	8
56	Boat Pump-Out Station	2

7. PROGRESS SCHEDULE: As soon as possible after receiving Notice of Award and before any work is begun, submit a Progress Schedule (normally in bar chart form) showing estimated starting and completion and dates for each part of the work.

8. SCHEDULE OF VALUES: In conjunction with the Progress Schedule, submit a schedule of dollar values of the various portions of the work whose aggregate equals the contract sum. Each item shall include its proper share of overhead and profit. When approved, the Schedule of Values shall form the basis of progress payments as provided in Clause 7 of the General Provisions.

9. REVIEW OF SCHEDULES: Both the Progress Schedule and the Schedule of Values shall be submited to review and modification by Contracting Officer both for format and content.

10. PHOTOGRAPHS OF WORK

Prior to start of construction, the Contractor shall photograph the areas affected by the project as designated by the Contracting Officer. The Contractor shall provide a continuous series of colored slides at the designated areas. Such areas shall include, but not be limited to, streets, rights-of-way, construction storage areas, and haul roads affected by the project.

The color slides will be on a 35 mm film, with the photography performed by the Contractor under the immediate supervision of the Contracting Officer. All cost of the pictures and slides will be borne by the Contractor and shall be included in the contract price.

All pictures and slides will become the property of the Government and will remain in the possession of the Contracting Officer, at whose Field Office they may be viewed, at any time, by all concerned parties. Upon final closeout, all photographs or slides will be retained by the Government.

The Contractor shall have the option of substituting video tape or movie footage of the designated areas. The substitution shall be requested in writing of the Contracting Officer. The request shall state, in specific terms, the details of the substitution and the viewing capabilities provided during the project life.

END

1. CONSTRUCTION STAKING, LINES AND GRADES: Refer to "Layout of Work" in Section 01010.

2. CUTTING AND PATCHING:

A. The Contractor shall do all cutting, fitting, connecting, digging, and patching of his work which is required to make its several parts come together properly as shown on the drawings and specifications for the completed work.

B. The Contractor shall do no cutting, digging, or otherwise altering of the work which endangers the structure; and shall cut no structural members except by the Contracting Officer's signed permission.

C. Any and all costs occasioned by badly timed and defective work shall be paid by the party responsible therefor.

END

1. SIGNS, SIGNALS, AND BARRICADES: Provide, erect, and maintain barricades, lights, danger signals and warning signs, and take all necessary precautions for the protection of the work and safety of the public. Provide, erect, and maintain sufficient approved detour signs at road closures and along detour routes. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise. All barricades and signs shall be in accordance with Part VI, American National Standards Institute (ANSI) Standard D6.1, Manual of Uniform Traffic Control for Streets and Highways.

2. UTILITIES:

A. Water: Contractor furnished. Water for construction purposes is available from the lake.

B. Electricity: Electricity will be Government furnished without charge. Contractor may use Government electricity by connecting to existing outlets at points to be designated by the Contracting Officer. If the existing outlets are not convenient, Contractor may furnish his own portable generator to provide electricity. Electricity at the Park for construction purposes is very limited and in most cases will consist of only one 110 volt outlet.

C. Telephone: No telephone service is available at the Park.

D. Heating, Ventilating, and Lighting: Provide and maintain adequate, approved facilities, as required for safety and construction requirements, during the progress of the work.

E. Interruption of Existing Services: Permitted only with prior consent of Contracting Officer. (See Section 01050).

3. STORAGE FACILITIES:

A. Confine storage of materials to the area of the incinerator at Rock Harbor, and the generator building incinerator area of Mott Island.

B. Provide temporary sheds or other covered facilities for storage of materials subject to weather damage. Number and size of structures shall be subject to Contracting Officer's approval. Locate structures to avoid interference with work and relocate as required by progress of work.

C. Remove structures and surplus stored materials at completion of work.

4. SANITARY FACILITIES:

A. Provide and maintain facilities in compliance with applicable state and local laws, codes, and ordinances.

B. Provide cool, potable water for construction personnel in locations convenient to work stations.

C. Provide sufficient lighted and ventilated toilet facilities in weatherproof, sightproof, sturdy enclosures. Place in approved locations where facilities will be secluded from public observation and convenient to work stations. Relocate as work progress requires. The geology of the Park is such, that in most cases pit toilets constructed below grade may not be feasible due to exposed rock formations, and therefore, in most instances, above ground chemical type toilets will be required.

D. Completely remove temporary facilities on completion of work.

5. FIELD OFFICE: If Contractor elects to establish an office for his own use, the size, location, and construction shall be subject to approval. This office must be removed at the completion of work.

6. CONSTRUCTION CAMP: Establishment of a camp will be permitted at the area of the incinerator at Rock Harbor, and at the generator building incinerator area of Mott Island.

Electricity and water at the construction camps will be Government furnished without charge, subject only to availability. Provide and maintain temporary toilet facilities in accordance with State Health Department and National Park Service requirements. Keep camp neat and clean and completely obliterate at completion of work. These requirements also apply to all Contractor's employees who may, with prior approval, establish their own camping facilities. Electricity and potable water service at the areas where construction camps are allowed is very limited and in most cases will consist of only one 110 volt outlet and one water connection per camp.

If a barge or houseboat is to be used for workers' quarters, it must have self-contained pumpout facilities and a wastewater holding tank of adequate capacity. Docking areas for barges will be designated by the Contracting Officer. Wastewater pumpout facilities for water craft are available at both Windigo and Mott Island.

7. SAFETY CONTROLS:

A. Shoring, Bracing and Protection: Shoring including sheet piling and bracing where required during the excavation, shall be installed to protect workmen, the banks of the excavation, and adjacent structures and utilities. The Contractor shall and hereby does assume responsibility for adequacy and safety of shoring and bracing.

After the excavation is complete, sheet piling, shoring and bracing shall, in general, be removed. The removal of sheeting, shoring and bracing shall be concurrent with the backfilling operations and shall be performed in such manner as to prevent damage to the work and adjacent structures, and for the safety of personnel. Voids left in the removal of sheet piling shall be filled by methods approved by the Contracting Officer.

Should the Contracting Officer determine that sheeting and/or shoring cannot be removed without endangering the work of adjacent structures or properties, he may, in writing, order the sheeting and/or shoring left in place.

B. Blasting: Blasting for excavation will be permitted only after securing the approval of the Contracting Officer and only when proper precautions are taken for the protection of persons or property. The hours of blasting shall be fixed by the Park Superintendent. Any damage caused by blasting shall be repaired by the Contractor at his expense. The Contractor's methods of procedure in blasting shall conform to state laws and municipal ordinances.

8. NOISE CONTROL:

The Contractor shall comply with all Federal, State and Local Noise Control Regulations pertaining to the control of noise levels for public and occupational safety and health.

9. DUST CONTROL:

The Contractor shall comply with all Federal, State, and Local Air Pollution Control Regulations. Where dust and/or other air borne contaminants produce a nuisance condition, the Contractor shall take appropriate measures to control these conditions. The control of dust shall be accomplished by the use of acceptable dust palliatives or watering as approved by the Contracting Officer.

END

1. PRESERVATION OF NATURAL FEATURES: Confine all operations to within the work limits of the project. Exercise special care to maintain natural surroundings undamaged. Do not remove, injure, or destroy trees or other plantings without prior approval. Do not fasten ropes, cables or guys to existing trees for anchorage. Restore damaged trees or natural features as nearly as possible to original condition at no additional expense to the Government.

2. HOUSEKEEPING:

A. Keep project neat, orderly, and in a safe condition at all times. Immediately remove all hazardous rubbish. Do not allow rubbish to accumulate. Provide on-site containers for collection of rubbish or dispose of it at frequent intervals during progress of work.

B. Wet down dry materials and rubbish to prevent blowing dust.

C. Keep volatile wastes in covered containers.

3. DISPOSAL OF RUBBISH: Dispose of waste materials, legally, at public or private dumping areas ouside the park. Do not bury wastes inside the park.

4. AIR AND WATER POLLUTION CONTROL:

A. Take all necessary reasonable measures to reduce air and wate pollution by any material or equipment used during construction.

B. No burning of debris will be permitted inside the park.

C. Do not dispose of volatile wastes or oils in storm or sanitary drains, nor allow such materials to reach streams or lakes.

D. Do not allow waste materials to be washed into the bed of a stream or lakes.

E. When excavations are made, immediately utilize resultant loose earth by filling and compacting in place, or dispose of it off the site in a disposal area approved by the Contracting Officer.

F. Sod or seed slopes with plant species as approved by the Contracting Officer as soon as possible to prevent erosion and deposit of earth into any storm sewer, drainage ditch, or stream. If it is impossible to prevent erosion, the Contracting Officer may require construction of sedimentation basins to prevent water pollution.

5. FIRE PREVENTION AND PROTECTION:

A. Hazard Control: Take all necessary precautions to prevent fire during construction. Provide adequate ventilation during use of volatile or noxious substances.

B. Spark Arresters: Equip all gasoline or diesel powered equipment used in potential forest or grass fire locations with spark arresters approved by the U.S. Forest Service. Written determinations of areas and periods of potential fire hazard will be issued by Contracting Officer.

C. Safety Precautions: Smoking will be strictly forbidden near all fuel storage areas.

D. Protection Equipment Required: Provide and maintain suitable fire protection equipment. Furnish a minimum of one UL Class 2A, 2-1/2 gallon water type, stored pressure extinguisher, and one UL Class 10, Type I, 15 pound B:C carbon dioxide extinguisher for each fuel storage area. Travel distance from any work station to the nearest extinguisher shall not exceed 100 feet.

END

1. CLEANING:

A. Products: Use cleaning materials recommended by manufacturer of surface to be cleaned and follow directions on container.

B. Exterior Cleaning: Sweep paved surfaces; rake other surfaces or grounds. Clean building surfaces with recommended products.

C. Interior Cleaning: Vacuum clean interior building areas when ready for painting and continue vacuum cleaning as needed until acceptance of building.

D. Mechanical Equipment: Replace filters if heating or air conditioning units were operated during construction. If operated without filters, clean ducts, blowers, and coils.

E. Final Cleaning: Remove all tools, equipment, surplus materials, and rubbish. Repair marred surfaces and remove grease, dirt, stains, foreign materials, fingerprints, and labels from interior and exterior finished surfaces. Do any required waxing and polishing. At time of final inspection, project shall be thoroughly clean and ready for occupancy.

2. PROJECT RECORD DRAWINGS:

A. Using colored ink, make changes on a set of clean prints of original tracings. Indicate all changes and revisions to the original design which affect the permanent structures and will exist in the completed work. Reference underground utilities to semipermanent or permanent physical objects. Reference water, sewer, telephone, and electric lines to corners of buildings.

B. Keep record drawings current, Inspection will be made monthly. Certification of accuracy and completeness will be required on monthly submitted payment requisitions.

3. SUBSTANTIAL COMPLETION AND FINAL INSPECTION: Submit written certification that project, or designated portion of project, is substantially complete, operational, and performing the service or function intended; and request, in writing, a final inspection. Contracting Officer will make an inspection within 10 days of receipt of request.

Should Contracting Officer determine that the work is substantially complete, he will prepare a punch list of deficiencies that need to be corrected before final acceptance, and issue a notice of substantial completion with the deficiencies noted. Should Contracting Officer determine that the work is not substantially complete, he will immediately notify Contractor, in writing, stating reasons. After Contractor completes work, he shall resubmit certification and request for final inspection.

4. ACCEPTANCE OF THE WORK: After all deficiencies have been corrected, a Letter of Final Acceptance will be issued. If only designated portions of the project have been inspected, a Letter of Partial Acceptance will be issued for that portion of the work.

Acceptance may be given prior to correction of deficiencies which do not preclude operation and use of the facility; however, final payment will be withheld until all deficiencies are corrected.

Until receipt of Letter of Final Acceptance, Contractor shall be responsible for the work of this Contract.

5. OPERATING INSTRUCTIONS: After the equipment and systems are in complete operation, and at a time set by Contracting Officer, Contractor shall arrange for qualified persons to instruct park personnel in the operation of the various elements of mechanical and electrical equipment and systems. Contracting Officer will determine who shall receive instruction. See Section 01300, Article 6.

6. CLOSEOUT SUBMITTALS: Submit before final payment request.

A. Project Record Drawings: As specified above.

B. Maintenance Manuals: Furnish, in quadruplicate, complete literature, operating and maintenance instructions, and technical data on all specific items of mechanical and electrical equipment.

C. Guarantees and Bonds: As specified in individual sections.

D. Spare Parts and Materials: As specified in individual sections.

E. Keys and Keying Schedule: As specified in Section 08710.

7. POST-CONSTRUCTION INSPECTION: Prior to expiration of one year from date of final acceptance, Contracting Officer will inspect project to determine whether corrective work is required. Contractor will be notified in writing of all deficiencies. In accordance with terms of the General Provisions, corrective work must start on noted deficiencies within 10 days of receipt of notification to Contractor.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of clearing and grubbing, tree pruning, tree and shrub removal and related vegetative matter removal in the areas shown on the drawings.

1-2 DEFINITIONS:

A. Clearing: Clearing shall consist of felling and cutting of trees, the trimming of trees left standing, and the removal of and disposal of all trees, logs, down timber, shrubs, brush, weeds, grass, other herbaceous vegetation and rubbish.

B. Grubbing: Grubbing shall consist of the removal and disposal of stumps, hedges and roots.

C. Tree Pruning: Tree pruning shall consist of the trimming and removal of dead branches and live branches designated for removal.

1-3 PROTECTION: Trees, shrubs, and other vegetation to be left standing shall be protected from damage during clearing and other construction operations. In the event that any tree or shrub designated to be left standing is damaged by the Contractor, such plants shall be repaired immediately or replaced, in accordance with standard horticultural practice, at no additional expense to the Government.

PART 2: MATERIALS: Approved tree wound compound.

PART 3: EXECUTION

3-1 CLEARING AND GRUBBING: Perform clearing and grubbing (1) in areas to be excavated, and (2) in other areas as designated on the drawings.

A. Trees and Shrubs: Trees, stumps, shrubs, bushes and roots within the above designated areas (1) shall be pulled, grubbed, or otherwise removed to a depth of not less than twelve (12) inches below the elevation of the subgrade, the finished earth surface, or the original ground line, whichever is lower. Trees, stumps, shrubs, bushes, and roots within the above designated area (2) shall be cut off at or slightly below ground level.

B. Vegetation: The above designated areas (1) shall be cleared or stripped of any remaining vegetation such as brush, growing corn, weeds, grass, cornstalks, roots, and other herbaceous vegetation, and all decayed vegetable matter, rubbish, and similar unsuitable materials. Above designated area (2) shall also be cleared or stripped as above when so noted on the drawings.

3-2 TREE PRUNING: All dead branches and live branches designated by the Contracting Officer for removal, shall be trimmed out of individual trees and groups of trees left standing which are designated for trimming by the drawings. All limbs and branches required to be trimmed shall be neatly cut to the bole of the tree or to the main branches, and cuts greater than 1 1/2 inches in diameter thus made shall be painted with an approved tree wound paint.

3-3 PRUNING OF TREES WITH DAMAGED ROOT SYSTEM: The work covered consists of all operations necessary to prune those trees whose root systems were damaged during excavation work. Trees to be pruned will be tagged by the Contracting Officer prior to the initiation of work in this Section.

Determination of Percent Crown to be Removed - The percentage of crown to be pruned will equal the percentage of the root system severed or covered with an impervious material that lies within the drip line of the tree. The percentage of crown to be removed will in no case exceed 40 percent of the total existing foliate. The percentage of crown to be pruned must be approved by the Contracting Officer prior to initiation of the work by the Contractor.

Pruning Techniques - Pruning shall follow commonly established techniques. All cuts shall be flush with the existing branch or trunk and all wounds shall be painted with tree wound compound to prevent disease. In no case shall a central leader or trunk be pruned. Large branches shall be undercut first to prevent the bark from being ripped below the cut. Selected pruning shall be employed to remove the established percentage of crown. In no case shall the tree be topped or the total percentage be removed from one area within a tree.

Supervision - Upon request by the Contracting Officer, the Government will provide supervision of the pruning operation to insure the initial quality of the procedures and adherence to the above specifications.

3-4 DISPOSAL OF ORGANIC MATERIAL:

Disposing of Organic Material: All brush, limbs, tops, and other debris resulting from the clearing, or such material may be reduced to chips by processing through a brush chipping machine. When a brush chipping machine is used, the chips shall be disposed of outside the limits of the project site, or stored for future use as mulching material in a manner approved by the Contracting Officer.

END

PART 1: GENERAL

1-1 DESCRIPTION: Improvement B & C: The work of this section consists of the removal and disposal of existing fuel storage facilities as shown on the Contract drawings, including tanks, tank supports, piping, and abandonment of buried gasoline tanks.

DESCRIPTION: Improvement D and E: The work of this section consists of the removal and disposal of the existing water piping and disconnection of the piping at the existing elevated water tank as shown in the Contract drawings and as directed by the Contracting Officer. Removal of piping will be limited to that shown on the Contract drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavation and backfilling - Section 02220; Earthwork - Section 02200; Site Grading Section 02210; Lawns - Section 02820; Grout - Section 03600.

1-3 STANDARDS AND REGULATIONS: National Fire Protection Association (N.F.P.A.) Code No. 30; Michigan Flammable Liquids Regulation .

PART 2: MATERIALS None.

PART 3: EXECUTION

3-1 GENERAL: Removal of existing storage tanks shall be in accordance with the above referenced Codes and Standards. Where a conflict occurs between the two standards, the Michigan Flammable Liquids Regulations shall have precedence.

3-2 DAMAGE: The Contractor is responsible for any damage of adjacent property and damage to tanks designated for relocation which is caused by removal operations. Necessary repairs to property or tanks will be provided by the Contractor at no additional expense to the Government.

3-3 REMOVAL OF ABOVE - GROUND TANKS:

A. Removal of Tanks to be Relocated: Remove each tank designated for relocation in a safe manner and in one piece, taking care not to damage the tank in any way. Damage to tanks resulting from removal will be repaired by the Contractor at no expense to the Government.

B. Removal of Tanks Not Designated for Relocation: Remove each tank in a safe manner. The Contractor has salvage rights for all tanks removed which are not to be relocated.

3-4 REMOVAL OF BURIED TANKS: Remove tanks in a safe manner. The Contractor has salvage rights for all buried tanks removed. Backfill excavations and grade to match natural topography.

3-5 REMOVAL OF TANK FOUNDATIONS AND SADDLE SUPPORTS: Remove concrete footings and saddle supports. Disposal of materials removed is included as part of this section of the specifications.

3-6 REMOVAL OF PIPING: Remove piping as shown on the drawings. The Contractor shall dispose of materials as specified by the Contracting Officer.

3-7 ABANDONMENT OF BURIED TANKS: The tanks shall be opened and all flammable materials removed from the tanks and the tanks filled with a grout.

3-8 DISCONNECTION AT EXISTING ELEVATED WATER TANK: Disconnect piping as shown on the Contract drawings.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of stripping topsoil and preparation of subgrade soils in areas designated on the drawings and herein. Included in this section of work is stripping and stockpiling topsoil from areas prior to construction of slabs or buildings; preparation of subgrade soils prior to construction of slabs, footings, roads; and covering the piping.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Clearing & Grubbing - Section 02100, Site Grading - Section 02210, Excavation and Backfill - Section 02220.

PART 2: MATERIALS

GRANULAR MATERIALS FOR FILL AND SUBBASE: Granular materials for use as fill, trench, backfill, subbase and filter aggregates shall consist of sand, gravel, crushed stone, foundry sand, blast-furnace slag, or a combination thereof conforming to the respective requirements specified in MSH&T 8.02.05, Class I. Granular material used in the construction of subbase may be produced from salvaged concrete provided that it meets the grading requirements of MSH&T 8.02.05, Class I and contains only negligible steel reinforcement. Material which may be cementitious or not suitable for water percolation shall not be used.

When used for trench backfill, no stones larger than 1 inch shall be placed within 12 inches of the pipe.

Foundry sand shall be free of combustible material and may contain only negligible quantities of iron. It shall not be used for filling over sewers with open joints, pipe with perforations, metal utility service pipes, or conduits.

Foundry sand shall not be used for subbase.

PART 3: EXECUTION

3-1 STRIPPING AND STOCKPILING TOPSOIL: At locations where ground slabs or structures are to be constructed, strip topsoil and stockpile for later use. Depth of stripping will be determined in the field by the Contracting Officer.

3-2 SUBGRADE PREPARATION: After excavating to grade, roll, vibrate, or tamp subgrade soils to achieve, as nearly as possible, a uniform density (see reference below) throughout the excavated area. Remove soft, yielding, or other unsuitable material which cannot be compacted satisfactorily. Fill holes or depressions, resulting from removal of unsuitable material, with satisfactory material and compact to conform with surrounding subgrade surface. Do not proceed with further construction before the subgrade is checked by the Contracting Officer, and approved, and at no time when the subgrade is frozen or muddy. For compaction see Section 02220, Article 3-4 E.

3-3 COVERING PIPING LAID ON TOP OF GROUND: Cover piping laid on top of ground with approved material as shown on the drawings. Minimum cover over pipe shall be 6 inches.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of grading, as shown on the drawings, in the areas of structures, roads, piping and abandoned tanks.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Earthwork - Section 02200; Special Controls - Section 01560; Excavating and Backfilling - Section 02220.

PART 2: MATERIALS

2-1 FILL MATERIALS: In general, site filling shall generally be accomplished with the excavated materials from the project site. Should the project plans not contain sufficient quantities of proper fill materials, obtain extra material from an approved source.

2-2 STRUCTURAL FILL MATERIALS: Fill materials, to be used beneath slabs or footings, shall be uniformly graded, from coarse to fine, having a maximum size of 1-inch and shall have 2 to 10 percent passing the No. 100 sieve and conform to MSHT 8.02.05 Class I. Material may be crushed stone or gravel, sand-gravel mixtures, or clean sand.

PART 3: EXECUTION

3-1 SITE GRADING: Grade areas shown on the Site Plan to conform with the contours indicated. Where filling is necessary, use materials specified in Part 2.

3-2 FILLING: In areas to receive fill, clean area of all deleterious substances which would affect the construction of the fill. Place fill in layers of uniform thickness and thoroughly compact as specified below.

A. Placement of Fill: Layers shall not exceed 8 inches in thickness where compaction is by mechanical rollers, or 4 inches where compaction is by mechanical tamps.

B. Compaction: Compact fill to the densities shown in Section 02220, Part 3 - 3D and 4E except where uncompacted fill is clearly shown on the drawings. The density requirements are expressed as a percent of maximum dry density obtained at optimum moisture content as determined by ASTM D-1557, Method A or C.

END

Part 1: GENERAL

1-1 DESCRIPTION: This section of work consists of excavation, backfilling and compaction of materials to construct the earth grade within the limits of work or as necessary for the construction in accordance with the specifications and in conformance with the lines, grades, thicknesses and typical cross sections shown on the drawings or established in the field for tanks and pipelines.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Earthwork - Section 02200; Demolition - Section 02110.

1-3 DEFINITIONS:

A. Trench Excavation and Backfill: Trench excavation and backfill are those operations pertaining to excavating and filling trenches for piping in accordance with Class A1, A2, and B Pipe Concealment Details as shown on the Contract drawings.

B. Structural Excavation, Backfill and Compaction: Structural excavation, backfill, and compaction are those operations related to excavating and filling for sturctures, including buildings, tank foundations, and containment structures.

C. Tank Excavation: Tank excavation consists of excavations required for the removal of buried tanks.

D. Common Excavation: Common excavation shall consist of all excavation not included as rock excavation or excavation which is otherwise classified and paid for, including existing flexible type pavement.

E. Unclassified Excavation: Unclassified excavation shall consist of the excavation and disposal of all materials of whatever character encountered in the work.

F. Dewatering: All pumping and bailing, building of all drains and all other work, also furnishing of all materials, fuel, electric current and personnel necessary to keep trenches and excavations free of water at all times during progress of construction, is included in this contract, under this section. The Contractor is also required to provide a means of conveying water from excavation to approved discharge point.

PART 2: MATERIALS

2-1 FILL MATERIALS:

A. Trench Backfill Materials: Backfill materials shall be as shown on the Contract Drawings and shall be free from cinders, ashes, refuse, organic matter, boulders, rocks, or stones.

1. Gravel: Gravel used for backfill shall consist of natural bank gravel having durable particles graded from fine to coarse in a reasonably uniform combination with no boulders or stones larger than 2 inches in size. It shall be free from slag, cinders, ashes, refuse, or other deleterious or objectionable materials. It shall not contain excessive amounts of loam and clay and shall not be lumpy or frozen. No more than 15 percent shall pass a No. 200 sieve.

2. Limestone Screenings: Screenings shall consist of the products obtained from crushing sound limestone or dolomite ledge rock and shall be free from shale, dust, excessive amounts of clay, and other undesirable materials. All materials shall pass a 1/2 inch sieve, and no more than 25 percent shall pass a No. 100 sieve.

3. Sand: All sand used for backfill shall be a natural bank sand, graded from fine to coarse, not lumpy or frozen, and free from slag, cinders, ashes, rubbish, or other material that is objectionable or deleterious. It shall not contain a total of more than 10 percent by weight of loam and clay, and all material must be capable of being passed through a 3/4 inch sieve. Not more than 5 percent shall remain on a No. 4 sieve.

4. Use of Excavated Material as Backfill: When the type of backfill material is not indicated on the drawings or

specified, the Contractor may backfill with the excavated material, provided that such material consists of loam, clay, sand, gravel, or other materials that, in the opinion of the Contracting Officer, are suitable for backfilling. If excavated material is indicated on the drawings or specified for backfill, and there is a deficiency due to rejection of part thereof, the Contractor shall furnish the required amount of sand, gravel or other approved material.

B. Structural Backfill Materials: Materials used for structural backfills shall be crushed stone or gravel, sand-gravel mixtures, or clean cohesionless sand. The material shall be uniformly graded from coarse to fine, with a maximum size of 1-inch and 2 to 10 percent passing the No. 100 sieve.

C. Water and Sewer Lines, Electrical and Telephone Conduits Excluding PVC: Suitable material in which all material passes a 3/4 inch sieve; excavated material which meets this grading requirement may be used for select backfill.

D. Electrical Cable and PVC Pipe: Graded sand, gravel, or sandy soil in which all material passes a No. 4 sieve with not more than 10 percent passing a No. 200 sieve; excavated material which meets this grading requirement may be used for select backfill. The graded material shall conform to Michigan State Highway and Transportation 8.02.06 - 3FS except for percent passing No. 200 above.

E. Water: Clean, free from harmful substances.

PART 3: EXECUTION

3-1 STRUCTURE EXCAVATION:

A. Excavation Dimensions: Provide 18 inches of clear working space between the exterior lines of the structure and the face of the excavation or shoring. In all cases, extend to solid bearing and below frost line.

B. Foundation Treatment: Clean all rock or other foundation material of loose material and cut to a firm surface either level, stepped, or serrated as directed. Avoid excavation below the specified grade.

C. Excavation Approval: When excavation has been completed for a structure, the Contractor shall notify the Contracting Officer, who will inspect the excavation. Place no concrete until the excavation is approved.

3-2 TRENCHING:

A. Pipe Trenching: The trench shall be dug so that the pipe be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipe laying as permitted by the Contracting Officer. The trench shall be so braced and drained that the workmen may work in it safely and efficiently. It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains, or sewers.

B. Excavation to Grade: The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes. Any part of the bottom of the trench excavated below the specified grade shall be corrected with approved material, thoroughly compacted as directed by the Contracting Officer. The finished subgrade shall be prepared accurately by means of hand tools.

The subgrade beneath the center line of the pipe shall be finished to within 0.03 feet of a straight line between pipe joints or batter boards and all tolerances shall be above the specified grade.

C. Excavation in Poor Soil and Refilling to Grade: Where the bottom of the trench at subgrade is found to be unstable, or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces of fragments of inorganic material that in the judgment of the Contracting Officer should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth requested by the Contracting Officer. An equitable adjustment will be made under Clause 3 of the General Provisions for such additional work.

D. Special Foundation in Poor Soil: Where the bottom of the trench at subgrade is found to consist of material that is unstable to such a degree that in the opinion of the Contracting Officer, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of piling, timbers, or other materials, in accordance with plans prepared by the Contracting Officer. An equitable adjustment will be made under Clause 3 of the General Provisions for such additional work.

E. Width of Trench: The width of trench shall be ample to permit the pipe to be laid and joined properly, and the backfill to be placed and compacted as specified. Trenches shall be of extra width when required, as will permit the convenient placing of timber supports, sheeting and bracing, and handling of special materials. For the maximum width of trench see the Drawings.

F. Pipe Clearance in Rocks: Ledge rocks, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipes and fittings unless shown otherwise on the Contract Drawings. The specified minimum clearances are the minimum clear distances that will be permitted between any part of the pipe and appurtenances being laid and any part, projection, or point of such rock, boulder, or stone.

G. Restoration of Damaged Surfaces and Property: If any pavement, trees, shrubbery, fences, poles, and other property and surface structures have been damaged, removed, or disturbed by the Contractor, such property and surface structures shall be replaced or repaired at no expense to the Government.

3-3 TRENCH BACKFILL AND COMPACTION:

A. Backfill Around Pipe: From the bottom of the trench to a depth of 1 foot above the top of the pipe, the trench shall be backfilled by hand or by approved mechanical methods. The Contractor shall use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe. The type of backfill material used and the method of placing and consolidation shall be as indicated in the drawings.

B. Backfill Where Settlement is Unimportant: Where shown on the drawings or directed by the Contracting Officer, the Contractor may backfill the trench from one foot above the pipe to the top of the trench with the excavated material, and the backfill shall be rounded over the trench to a sufficient height to allow for settlement to grade with consolidation.

C. Backfill Under Roadways: Where the excavation is made through or the trench undercuts roadways, driveways, parking areas or other vehicular routes, the entire trench shall be backfilled and compacted using approved gravel-sand or limestone as previously defined.

D. Bracing Removal: Sheathing shall not be withdrawn where used in connection with the work until trench is sufficiently filled to prevent injury to banks, road surfaces, adjacent pipes, and other property.

E. Backfilling in Freezing Weather: Backfilling shall not be done in freezing weather except by permission of the Contracting Officer, and it shall not be made with frozen material. No fill shall be made where the material already in the trench is frozen.

3-4 STRUCTURES AND PAVEMENT FILL, BACKFILL AND COMPACTION:

A. Drainage Fill: Drainage fill shown to be constructed immediately below the concrete slabs of structures shall be constructed at all locations shown and in strict accordance with the details of the drawings. After the subgrade is prepared and prior to the placement of concrete the granular drainage fill material shall be placed and spread uniformly to a thickness not less than that shown. After spreading and after the surface of the material has been shaped to conform to the profile of the bottom of the slab, the granular material shall be thoroughly wetted and tamped, rolled or otherwise compacted to form a uniformly dense layer.

B. Fill: Areas to receive fill shall be cleaned of all deleterious substances which would affect the construction of the fill. Loam, organic or other material in the surface of the area to be filled, when determined to be unsuitable for the foundation of the fill, shall be removed.

C. Spreading Fill Material: Where compaction is permitted by use of sheepsfoot rollers, pneumatic rollers, three-wheel rollers or other power rollers, the fill material before rolling shall be spread in horizontal layers having a uniform thickness not exceeding eight inches, loose measure. Where compaction is required by the use of mechanical tamps, filled material shall be spread in horizontal layers having uniform thickness not exceeding four inches, loose measure. The rate at which fill materials are placed and spread shall, at all times, be regulated such that the tamping and/or rolling equipment can obtain thorough and uniform compaction of each layer to the density as hereinafter specified.

D. Backfill:

1. Preparation: After forms for concrete masonry have been removed and after the surface of the concrete has been pre-

pared to receive backfill; after unit masonry construction below grade is completed; after dampproofing of walls, if required, is completed; after below grade utility lines have been installed, inspected and approved, and all specified tests have been performed; and all other work required to be performed prior to backfilling is complete; the excavation shall be cleaned of all waste concrete, spalls from masonry units, lumber sticks and other deleterious substances and shall then be backfilled as hereinafter specified.

2. Completion of Work: Backfill against concrete walls will not be permitted prior to the expiration of the specified curing time applicable to the latest concrete placed in the completed wall and in no case earlier than seven days following the completion of concrete placement. Backfill against concrete walls of a design such that horizontal support for the wall is provided by slabs, struts, or other structural systems located near the top of the wall shall not be started until after the slabs, struts, or other structural systems are completed. Backfill against unit masonry walls shall in no case be placed earlier than 48 hours after the masonry is completed. In cases where the masonry wall is to receive horizontal support from structural systems at the top of the wall, backfill operations shall not be started prior to completion of the structural system. Walls of any type, or other parts of the structure, damaged or showing excessive displacement as a result of the backfilling operation, shall be repaired or removed and rebuilt as directed by the Contracting Officer. Such work ordered repaired or removed and rebuilt shall be performed by the Contractor without additional cost to the Government.

3. Process and Utility Lines: Compacted cohesionless material as specified shall be placed as backfill under any process lines, utility lines or similar connections to the various structures, wherever such lines extend into or across excavated areas. Such backfill shall extend from the bottom of the excavation to a distance of at least 2 inches above the top of the line (pipe) and to horizontal limits starting six (6) inches beyond the outer diameter of the line and extending downward and outward at not less than a 1:1 slope.

4. Method: Material for backfill around structures located in the graded areas of the site shall be spread in horizontal layers four (4) inches thick, loose measure, and shall then be wetted or dried as required and compacted by means of

mechanical tamps to the density hereinafter specified. The backfill shall be placed in successive layers until the elevation of the natural ground or the subgrade elevation of slabs, pavements or drainage fill, as the case may be, is reached. Backfill for manholes, storm water inlets, valve vaults and boxes, culvert headwalls, and similar structures located in the graded area of the plant site shall be backfilled as specified above for structures located in diversion chambers, valve vaults and boxes, culvert headwalls, and similar structures located in upgraded areas of the plant site and other open areas shall be as follows: after the excavation is cleaned and made ready for backfill, materials from the excavation reasonably free of roots and sticks shall be placed in layers six (6) inches thick, loose measure, and compacted by use of hand or mechanical tamp until the excavation is backfilled to an elevation not less than one (1) foot above the top of the highest pipe entering or leaving the structure. The balance of the backfill may be placed in layers not exceeding 12 inches thick, compaction will not be required. The top of the backfill shall be rounded up sufficiently above the natural ground or grade elevation to assure that a depression will not develop around the structure after settlement of the backfill is completed.

E. Compaction: All fill and backfill shall be compacted to the density listed hereinafter, except where uncompacted fill is clearly noted on the drawings.

Each layer of backfill except in areas where compaction of the backfill is not required, shall be compacted by use of mechanical tamp of an approved design to the degree of density listed below. The degree of density is expressed in the percent of maximum dry density obtained at optimum water content as determined by ASTM Designation D-1557, Method A or Method C.

TABLE OF DENSITY REQUIREMENTS

Location of Fill or Backfill	Percent Maximum Dry Density at Optimum Water Content
Backfill or fill under slabs on earth or drainage fill and under pavements	95%
Backfill under stoops, steps and walks, and other items adjacent to the structure and having partial or total earth support	90%
All other fill or backfill	80%

A minimum of two (2) compaction tests for fill under slabs shall be required. These shall be made within the building limits by an independent testing laboratory. Reports of these tests shall be furnished to the Contracting Officer before concrete is placed. All tests shall be performed at no additional expense to the Government.

F. Shrinkage and Maintenance: Construct all embankments to required grade, width, and cross section. The Contractor shall be responsible for the stability of all embankments until final acceptance, and for replacing any portions which have become displaced due to carelessness or negligence.

G. Waste Material Disposal:

1. Disposal of Excavated Material: Except as hereinafter provided, excavated material shall, insofar as practicable, and if suitable, be used in embankment and special fill, or at such other places as may be specified or directed, depending on the nature of the material. No usable material shall be wasted without authority.

2. Disposing of Inorganic Material: Materials excavated or removed during the construction of the project shall become the property of the Contractor unless otherwise shown on the plans or in the proposal. Materials reserved for use shall be removed without damage to the material, and stored outside the limits of construction at the designated location and in the manner approved by the Contracting Officer. Materials that become the property of the Contractor shall be removed from the project before acceptance of the project.

3. Disposing of Organic Material: See Section 02100.

3-5 FIELD QUALITY CONTROL

A. Density Tests: Field density determinations shall be made in accordance with AA SHTO, T-191, or T-205. All references to soils in these methods of tests shall be interpreted to mean either or both cohesive and granular materials. After densities are determined, the degree of compaction shall be computed by the following formula:

$$\text{Percent Compaction} = \frac{\text{In place dry density (lbs/cu. ft.)}}{\text{Maximum dry density (lbs/cu. ft.)}} \times 100$$

The procedure for determining maximum dry densities for compaction control shall be as outlined in ASTM D-1557, Method A or Method C.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of the construction of drainage facilities as shown on the drawings. Included in this section of the work are subdrainage systems and drainage of secondary containment structures.

1-2 Related work specified elsewhere: Valves - Section 15100, Excavation and Backfill - Section 02200.

1-3 QUALITY ASSURANCE: References - American Society for Testing and Materials (ASTM); American Association of State Highway and Transportation Officials (AASHTO).

PART 2: MATERIALS

2-1 DRAINAGE PIPE: Drainage pipe shall conform to ASTM D-3034-73 SDR35, PVC gravity sewer pipe and fitting and be of the sizes shown on the drawings.

2-2 FOUNDATION DRAINS: Footing drains shall consist of perforated PVC or ABS plastic pipe 4 inches in diameter meeting ASTM D-1886. Pipe with round holes shall have holes not greater than 5/16 inch in diameter with a minimum of 8 holes per foot of pipe. If slotted pipe is used, slots will have a minimum dimension of 1/8 inch with not more than 4 slots at any cross-section and not less than 20 slots per foot of pipe.

2-3 INSPECTION:

A. Shop Inspection: All materials furnished by the Contractor are subject, at the discretion of the Contracting Officer, to inspection and approval at the manufacturer's plant.

B. Disposition of Defective Material: All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected by the Contracting Officer. All defective materials furnished by the Contractor shall be promptly removed by him from the site.

PART 3: EXECUTION

3-1 DRAINAGE PIPE:

Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades on a bed which is uniformly firm throughout its length. Any pipe which is not in true alignment, or which shows any undue settlement after being laid or is damaged, shall be taken up and relaid at no additional cost to the Government. Pipe shall be installed at the locations designated on the drawings in accordance with the lines and grades shown. The installation shall conform to the requirements of ASTM D-2321 with Class B bedding.

3-2 FOUNDATION DRAINS: Install pipe as shown on the drawings with a minimum slope of 1/8 inch per foot.

3-3 DRAINAGE DITCHES: Construct drainage ditches having the lines, grades, and cross-sections shown on the drawings. Upon completion of ditch construction, trim to within 0.25 feet of the grades and alignments shown on the drawings.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of construction of gravel roads and bituminous concrete pavements as shown on the drawings. Included in this section are placement, compaction and grading of base material and placement, grading and compaction of bituminous concrete surface, as required.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Earthwork - Section 02200; Site Grading - Section 02210; Excavation and Backfill - Section 02220.

1-3 QUALITY ASSURANCE: Reference Michigan Department of State Highways and Transportation (MDSH&T).

1-4 SUBMITTALS: Submit aggregate base coarse sample. (see Section 01300).

PART 2: MATERIALS

2-1 GRAVEL SURFACE COURSE: Materials shall conform to MDSH&T Standard Specification 8.02 Aggregate 22A.

2-2 GRAVEL BASE COURSE: Materials shall conform to MDSH&T Standard Specification 8.02 Aggregate 19A.

2-3 ASPHALT SURFACE COURSE: Materials shall be as listed and conform to MDSH&T Standard Specification 4.11 and as specified in MDSH&T Division 8.

2-4 BOND COAT: SS-1h, MS-2a or RS-1h.

PART 3: EXECUTION

3-1 GRAVEL SURFACE COURSE: Construction methods shall conform with MDSH&T Standard Specification 4.01. Construct gravel surface course locations and to grades and lines shown on the drawings.

3-2 GRAVEL BASE COURSE: Construction methods shall conform to MDSH&T Standard Specifications 3.01. Construct base course as shown on the drawings.

3-3 ASPHALT SURFACE COURSE: Construction methods shall conform to MDSH&T Standard Specification 4.11 and 4.12. Construct surface course in two courses, applying a bond coat between courses.

3-4 BOND COAT: Apply at a rate of 0.05 to 0.10 gallons per square yard between each course of surface material. Before bond coat is applied, clean the surface of all dust, dirt or loose material. If SS-1h or MS-2a is used, dilute with equal parts of water.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section includes the construction of galvanized vinyl-clad chain link fencing, posts and gates as shown on the drawings.

1-2 SCHEDULING: Schedule fencing work to phase in with other work so as to cause the least amount of inconvenience.

1-3 QUALITY ASSURANCE: References, American Society for Testing and Materials (ASTM), and manufacturers' printed recommendations. Refer to Cast-in-Place Concrete - Section 03300.

1-4 SUBMITTALS Submit Shop Drawings. (See Section 01300).

PART 2: MATERIALS

2-1 STEEL FABRIC CHAIN LINK FENCE: BLACK VINYL-CLAD

This fence shall conform to the requirements of ASTM Spec 116 for galvanized steel fabric and U.S. Government Spec RR-F-191 1A Type V galvanized core. The height of the fabric shall be 72" as shown on the drawings. It shall be of No. 9 gauge wire woven in 2 inch mesh. The top and bottom salvages shall have a twisted and barbed finish. The galvanized coating shall be done after weaving and shall be .30 oz./sq. ft., minimum. The vinyl-clad wire coating shall have a minimum thickness of .015 inches.

The fabric shall be furnished with ties required for fastening it to the top rail (1-5/8 inch O.D.) and bottom tension wires. These fastenings may be of 9 gauge O.D. vinyl-clad galvanized steel wire or 9 gauge O.D. vinyl-clad galvanized steel hog rings in accordance with the manufacturer's standard design. Sufficient ties shall be furnished or provided for attaching to top rail and bottom tension wires each 24 inches. Fittings necessary to make complete installation shall be pressed or rolled steel, forged steel, cast steel, or malleable iron, with epoxy-phenolic primed and coated with matching vinyl (PVC) by the fusion-bond method.

A. Tension Wire: Tension wire intended for use on the bottom of vinyl-clad galvanized steel chain-link fence shall be No. 6 gauge O.D. coiled spring vinyl-clad galvanized steel wire, and shall have a minimum tensile strength of 90,000 psi. The minimum weight of coating shall be 0.80 oz./sq. ft. of galvanized.

B. Top Rail: The top rail shall be 1-5/8 inch O.D. butt welded schedule 40 galvanized pipe vinyl-clad.

C. Stretcher Bars, Truss Rods, and Turnbuckles: Stretcher bars shall be 3/16 by 3/4 inch flat bars. These bars, truss rods, turnbuckles, and necessary fittings shall be of good commercial quality steel, malleable iron, or wrought iron, and shall be galvanized and vinyl-clad. The turnbuckles shall be made from drop forged malleable iron. They shall have a minimum take-up of 4 inches. The fittings may be pressed or rolled steel, forged steel, cast steel, or malleable iron with galvanized and vinyl-clad.

D. Braces: Braces shall be made of steel pipe with bolted steel couplings or connections and shall conform to the requirements of ASTM A-120. They shall be galvanized and vinyl-clad as set out therein. Any fabrication or manipulation that causes minor damage to the vinyl coating shall be corrected by approved application as recommended by the manufacturer. Braces with major damage will be rejected.

E. Steel Fence Posts: The vinyl-clad galvanized steel line post shall be 2" diameter and vinyl-clad galvanized steel corner post shall be 2-1/2" diameter. Tubular steel fence posts shall be galvanized in accordance with ASTM A-123 except the weight of zinc coating per square foot of actual surface on anchor plates attached to posts shall average no less than 1.80 ounces and shall be no less than 1.50 ounces for any individual specimen. Cut ends that are not placed underground shall be coated with high zinc dust-zinc oxide paint conforming to the requirements of Federal Specification TT-P-641. Posts and anchor plates for line posts shall be good commercial quality vinyl-clad galvanized steel and of the shapes, weights, and dimensions shown on the plans. All tubular section posts shall have heavy malleable iron caps made to provide a drive-fit over the outside of the section to exclude moisture. The weight per linear foot for tubular posts and braces shall be no less than 95 percent of the weight specified.

All line posts for chain-link fence shall be furnished with the necessary tie-wires or fabric bands for fastening the fabric to the posts. These fastenings shall be vinyl-clad galvanized steel wire of approved gauge and design and may be in accordance with the manufacturer's standard design. A sufficient quantity of individual ties shall be furnished to provide for attaching the fabric to each line post each 12 inches or as called for on the drawings.

F. Gates:

1. GAte Posts: Gate post sizes shall be as follows:

ANSI Nominal Pipe Size, inches	Swing Gate Opening, Feet	
	Single Gate	Double Gate
2-1/2	Up to 6	Up to 12
3-1/2	7 to 13	13 - 26

2. Steel Gates: Steel gate posts shall be standard weight, vinyl-clad galvanized, steel pipe conforming to the requirements of ASTM A-120 and furnished with all necessary fittings. Post sizes shall be as set out above. The gate frames shall be of standard weight, vinyl-clad galvanized, steel pipe conforming to the requirements of ASTM A-120; of 1-1/2 inch nominal size; and shall have welded joint or riveted construction using vinyl-clad galvanized pressed steel or malleable material meeting the requirements of Federal Specification O-G-93. Fabric coverings for gates shall be as specified above for chain-link fence. These gates shall be furnished with necessary fastenings, hinges, center stops and locking devices vinyl-clad galvanized steel. Padlock shall be keyed to the Government's master.

G. Fence Post Sleeves: Sleeves for fence posts imbedded in concrete walls shall conform to dimension of electrical conduit. The sleeves for 2" line posts shall be 2-1/2" conduit and the sleeves for 2-1/2" corner posts shall be 3" conduit. At the option of the Contractor the materials of the sleeves can be galvanized steel. The length shall be not less than 15".

H. Color: The vinyl-clad fencing shall be black and be a complete system for all parts and materials.

2-2 STEEL FABRIC CHAIN LINK FENCE: GALVANIZED

This fence shall conform to the requirements of ASTM Spec 116 for galvanized steel fabric and U.S. Government Spec RR-F-191 1A Type V galvanized core. The height of the fabric shall be 72" as shown on the drawings. It shall be of No. 9 gauge wire woven in 2 inch mesh. The top and bottom salvages shall have a twisted and barbed finish. The galvanized coating shall be done after weaving and shall be 2.0 oz./sq. ft., minimum.

The fabric shall be furnished with ties required for fastening it to the top rail (1-5/8 inch O.D.) and bottom tension wires. These fastenings may be of 12 gauge O.D. galvanized steel wire. in accordance with the manufacturer's standard design. Sufficient ties shall be furnished or provided for attaching to top rail and bottom tension wires each 24 inches. Fittings necessary to make complete installation shall be pressed or rolled steel, forged steel, cast steel, or malleable iron.

A. Tension Wire: Tension wire intended for use on the bottom of galvanized steel chain-link fence shall be No. 6 gauge O.D. coiled spring galvanized steel wire, and shall have a minimum tensile strength of 90,000 psi. The minimum weight of coating shall be 0.80 oz./sq. ft. of galvanized.

B. Gates:

1. Gate Posts: Gate post sizes shall be as follows:

ANSI Nominal Pipe Size, inches	Swing Gate Opening, Feet	
	Single Gate	Double Gate
2-1/2	Up to 6	Up to 12
3-1/2	7 to 13	13 - 26

2. Steel Gates: Steel gate posts shall be standard weight, galvanized, steel pipe conforming to the requirements of ASTM A-120 and furnished with all necessary fittings. Post sizes shall be as set out above. The gate frames shall be of standard weight, galvanized, steel pipe conforming to the requirements of ASTM A-120; of 1-1/2 inch nominal size; and shall have welded joint or riveted construction using galvanized pressed steel or malleable material meeting the requirements of Federal Specification O-G-93. Fabric coverings for gates shall be as specified above for chain-link fence. These gates shall be furnished with necessary fastenings, hinges, center stops and locking devices of galvanized steel. Padlock shall be keyed to the Government's master.

C. Fence Post Sleeves: Sleeves for fence posts imbedded in concrete walls shall conform to dimension of electrical conduit. The sleeves for 2" line posts shall be 2-1/2" conduit and the sleeves for 2-1/2: corner posts shall be 3" conduit. At the option of the Contractor the materials of the sleeves can be galvanized steel. The length shall be not less than 15".

D. Color: The galvanized fencing shall be complete system for all parts and materials.

PART 3: EXECUTION

3-1 GENERAL CONSTRUCTION REQUIREMENTS:

When the drawings require that posts, fences, or anchors be imbedded in concrete, the Contractor shall install temporary guys or braces, if required, to hold the posts in proper position, until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted, no materials shall be installed on posts or strain placed guys and bracing set in concrete until four days have elapsed from the time of placing of the concrete.

The tops of all posts shall be set to the required grade and alignment. Cutting of the tops of the posts will be allowed only with the approval of the Contracting Officer and under the conditions specified by him.

Wire or fencing of the size and type required, shall be firmly attached to the posts and braces in the manner indicated. All wires shall be stretched taut and be installed to the required elevations.

At each location where an electric transmission, distribution or secondary line crosses any of the types of fences covered by these specifications, the Contractor shall furnish and install a ground conforming to the requirements of Section 9 of the National Electric Safety Code.

3-2 SETTING POSTS:

Posts shall be set according to plans and such that the fence can be placed on the outside of the post. If an object such as a tree is located on the right-of-way and is to remain in place, the fence may be set off line enough to miss the object. There shall be a gradual offset for at least 3 posts in each direction to eliminate sharp bends.

Line posts for chain-link type fence shall be set on 10-foot (maximum) centers. A tolerance of +2 feet in spacing will be allowed at special locations as approved. Spacing of these posts shall be as uniform as practicable under the existing conditions. However, additional posts shall be set at each abrupt change in grade.

Pull posts shall be set at not to exceed 500-foot intervals in straight runs and, in addition, at each vertical point of 10 degrees or more.

Corner posts shall be set at each horizontal angle point of 10 degrees or more.

All end, corner, pull, and brace posts, all line posts for chain-link type fence, and all braces shall be set in Class 2500 or 3000 concrete as shown on the drawings.

Except where rock is encountered, intermediate or line posts shall be anchored in 6 inch diameter concrete bases 18" deep, or other satisfactory device to hold the post in proper alignment and plumb.

Gate posts shall be set 36 inches deep in Class 3000 psi concrete. The diameter of these footings shall be no less than 12 inches.

Extra length posts will be required at small ground depressions where it is not practicable for the fencing to follow closely the contour of the ground. These posts shall be set in Class 3,000 psi concrete as shown on the drawings.

When so directed, at ground depressions the Contractor shall close the space below the fence fabric with barbed wire, either on horizontal lines or fanned, as shown on the drawings or as directed.

The wires shall be stretched taut between and fastened to the posts to prevent vertical movement of the wires. Barbed wire will not be required where its installation would cause collecting drifts in the channel.

3-3 PLACING FABRIC:

The bottom of the fabric shall be placed a normal distance of 3 inches above the ground line. Over irregular ground a minimum 1 inch and a maximum 6 inch clearance will be permitted for a distance of not to exceed 8 feet. The Contractor shall perform any necessary excavation and backfilling required to comply with these provisions.

The tension required to stretch the fabric and barbed wire shall be applied by mechanical stretchers and with single wire stretchers designed and manufactured for the purpose, and in accordance with the fence manufacturer's recommendations.

All splices in the fabric and barbed wire shall be securely made in accordance with the manufacturer's recommendations and by the use of tools designed for that purpose.

The bottom tension wires of chain-link fence shall be placed, stretched taut, and secured at the ends and to all posts in a satisfactory manner before the fabric is placed. The ends of the fabric shall be secured by the use of stretcher-bars threaded through the loops of the fabric and secured to the posts by means of clamps with bolts and nuts. The number of clamps shall be as indicated on the standard plans. The fabric shall be placed by securing one end and then applying tension to remove all slack before making attachments elsewhere. The fabric shall be fastened to the line posts and spaced at 24-inch centers as shown on the standard plans.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work in this section consists of providing all lawn work as indicated on the drawings. This work includes, but is not necessarily limited to:

A. Spreading and grading of topsoil.

B. Seedbed preparation, including application of fertilizer.

C. Mulching.

D. Clean-up of exterior areas and maintenance of work performed until acceptance as described herein.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Earthwork - Section 02200; Site Grading - Section 02210.

1-3 INSPECTION AND ACCEPTANCE: The Contracting Officer shall be final judge as to the suitability of the work. The Contractor shall notify the Contracting Officer in writing when all the work under this section is completed. Inspection for final acceptance will be scheduled for 15 days after completion, provided inspection falls between June 1 and October 30. At the time of inspection, the Contracting Officer reserves the right to postpone final acceptance until that time in the future when positive acceptance or rejection can be determined.

1-4 SUBMITTALS: Submit certificates (See Section 01300).

PART 2: MATERIALS

2-1 TOPSOIL: Loose, friable, free from subsoil, debris, stones and adulterative or extraneous matter or any oil, grease or other contamination which will prevent or retard the growth of healthy plant material. It should have demonstrated, by the occurrence upon it of healthy vegetation, its ability to grow normal vegetation; it shall be obtained from a well-drained area and shall not be taken from a source known to contain any of the noxious weeds defined as such by State Seed Law. It shall have a pH analysis of 6.0 - 6.5:

Agricultural limestone for pH adjustment shall conform with the following:

A. Fineness (percent passing the No. 8 sieve) shall be no less than 80.0.

B. The total neutralizing value (calcium carbonate equivalent) shall be no less than 80.0.

C. The product of the 2 factors (fineness times calcium carbonate equivalent) shall be no less than 7200.

2-2 FERTILIZER: Commercial fertilizer composed of 10 parts nitrogen, 10 parts phosphate and 10 parts potash and known as 10-10-10 fertilizer. All fertilizer shall be delivered in original containers bearing the State Chemists' Guaranteed Analysis Tag.

2-3 SAND: Fill sand of good quality or masonry sand.

2-4 PEATMOSS: Raw native peat, friable, clean, free of substance, and in air-dry condition.

2-5 STRAW MULCH: Clean wheat or oat straw, free from primary noxious weed seeds, sprayed with an approved binder, or a spray mulch.

PART 3: EXECUTION

3-1 SOIL PREPARATION:

A. Placing Topsoil: The topsoil shall be dumped in piles uniformly spaced or otherwise distributed by approved equipment on the designated areas and then evenly spread over the areas by blade graders or other approved methods, to a minimum depth of four inches. The spreading shall be carried on in such a manner that seeding can proceed with little additional soil preparation or tillage. Any irregularities in the surface, resulting from topsoiling or other operations, shall be corrected in order to prevent the formation of depressions and pockets where water will stand. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry, or in a condition otherwise detrimental to the proposed plantings, or to proper grading. The Contractor shall demonstrate to the Contracting Officer before starting work that the application of the materials requried will be made at the specified rates.

B. Grading: Grades on the areas to be treated that have been previously established, as shown on the drawings, shall be maintained in a true and even condition. Maintenance shall include necessary repairs to previously graded areas. Where the grades have not been established, the areas shall be graded as shown on the drawings, and surfaces shall be left at the prescribed grades in an even and properly compacted condition so as to prevent the formation of depressions where water will stand.

3-2 FERTILIZING: The chemical fertilizer shall be evenly applied on the prepared surface at a rate which will provide 5.5 pounds per 1000 square feet of chemical fertilizer nutrients, in equal proportions of nitrogen, phosphoric acid and potash, or as directed by the Contracting Officer.

Fertilizer spread by drill or broadcast methods will be placed or worked into the soil to a depth of one to two inches. Fertilizer and fertilizer-seed slurries spread hydraulically shall be incorporated into the soil by lightly compacting into the upper one-half inch of the soil.

3-3 MULCHING:

A. All areas fertilized shall be mulched within 24 hours after fertilizing operations have been completed. Mulch shall be uniform, loose (not matted) bound with a binding compound, approved by the Contracting Officer, in accordance with manufacturer's directions and thoroughly wetted.

B. Should mulch become washed or blown away from parts of the lawn and therefore deposited too thickly on other parts, it must be evenly redistributed by the Contractor.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing the water intake structure and providing the piping, installing the intake screen with anchors and floats, the intake piping, submersible pump casing, all anchorage, supports, pipe encasement and appurtenances.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavation and Backfilling - Section 02220, Concrete - Division 3; Pipe and Pipe Fittings - Section 15060; Pipe Specialties - Section 15080; Valves, cocks and Faucets - Section 15100 and Hydro - Pneumatic System - Section 15231.

1-3 QUALITY ASSURANCE: Manufacturer's instructions, American Concrete Institute (ACI), American Society for Testing and Materials (ASTM), OSHA.

PART 2: MATERIALS

Materials as shown on the drawings and as specified in related work.

PART 3: EXECUTION

3-1 The installation of the intake structure shall be completely reviewed with the Contracting Officer prior to installation to establish a safe and effective method for the installation of the intake.

3-2 The 6 inch polyethelene pipe for the submersible intake pumps shall be installed as true and straight as possible to allow for the annual insertion and removal of the intake pumps. A method of assuring the straightness shall be reviewed with the Contracting Officer, however, final responsibility shall remain with the Contractor. A suggestion for maintaining straightness is to insert a mandrel of wood or steel which would be removed after the anchor collars and protective concrete is set and aged.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of construcging all formwork required for the construction of cast-in-place concrete slabs and structures.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cast-in-place Concrete - Section 03300.

1-3 QUALITY ASSURANCE: Reference, American Concrete Institute (A.C.I.).

PART 2: MATERIALS

2-1 FORM MATERIALS: Form work shall be of wood, plywood, metal, or other materials that will not adversely affect the surface of the concrete and that will produce or facilitate obtaining the specified surface finish of the concrete may be used. Damaged forms shall not be reused for exposed work. In general, the design of the formwork, as well as its construction, shall be the responsibility of the Contractor, with the prime requirement; however, that it gives the approved finish desired when the concrete conditioned is exposed: lumber for use as forms shall be free from warps, loose knots, rot or like defects. For unexposed rough work only undressed lumber may be used. Forms and related accessories shall be as follows:

A. Studs and Wales: "Construction Grade" or "Standard Grade" Douglas Fir or other species of equal strength characteristics not less than 2"x4" and selected for straightness.

B. Plywood Sheathing: Exterior type, concrete form grade, 5-ply Douglas Fir, not less than 5/8" thick, and conforming to CS 45.

C. Lumber Sheathing: No. 2 common or better lumber, tongued and grooved or ship lap boards of uniform thickness and evenly matched, surfaced all sides.

D. Metal forms of approved type that will produce surfaces equal to those specified for wood forms, except as otherwise specified in Item E below.

E. Steel waffle forms shall be rigid, deep drawn, one-piece units or heavy gauge steel, factory-punched to allow for hangers for suspended ceilings. Steel domes shall be designed to comply with the standards of the "Simplified Practice Recommendation" R265, published by the U.S. Department of Commerce and also meet details of typical domes as shown in latest CRSI Design Handbook.

F. Wall forms shall be designed for the loads and lateral pressures, using allowable stresses and design considerations outlined in ACI 347 "Standard Recommended Practice for Concrete Formwork", Section 102 and 103.

G. Form oil shall be a light clear paraffin base oil that will not discolor or otherwise injure the surface of the concrete and shall be approved for form use.

H. Column clamps shall be similar to Symons "Eversquare" column clamps, or equal. Provide column clamps in ample quantity so as not to delay progress of work.

I. Form ties shall be fixed or adjustable in length, free of lugs, washers or other devices that would leave hole or depression larger than 3/4" in diameter in back of exposed surface. Wire ties will not be permitted. Ties shall have a minimum working stress of 3000 lbs. when fully assembled. Ties that are to be pulled shall be coated with a graphite grease or equivalent material to facilitate removal, and shall be pulled from inside face.

PART 3: EXECUTION

3-1 FORMS AND CENTERING:

A. Construct forms complete with centering, cores and molds. Forms shall conform to the shape, lines and dimensions of the concrete members as shown on the drawings, and shall be made substantial and sufficiently tight to prevent leakage of concrete. They shall be properly braced or together so as to maintain position and shape and be free of surface defects.

Where required for forms subjected to unusual pressures from weight of concrete, the forms shall be constructed of special thick members as required by the conditions to prevent deflection of the forms, or the forms shall be constructed of steel plates reinforced with structural steel sections, lined on the inside with boards or plank.

B. All form material shall be new, except the forms originally constructed for this work may be reused so long as the material will produce structurally substantial forms, free from leakage and surfaces which are plane and true and free from defects. All material reused shall be cleaned free of adhering concrete and dirt. Planks and boards which are cracked, splintered or warped or plywood which has delaminated shall not be reused. Patching of forms will not be permitted for exposed or semi-exposed work.

C. All openings, recesses, offsets, brackets and the like shown or required in the concrete work, shall be provided in the form work. Anchorage devices shown or specified to be set in concrete shall be accurately located to templates.

D. Provide removable panels at bottom of concrete columns, walls and other forms as required for access to bottom of form space for cleaning and removal of rubbish and debris.

E. All forms shall be cleaned of all debris before concrete is placed. Formwork approved for concrete shall be properly protected until concrete is poured. Coatings of dust shall be removed from contact surfaces of forms before placing concrete. Provide live steam for ice and snow removal. All reinforcement shall be free of ice.

F. Positive means of adjustment by wedge or jack of shores and struts shall be provided and all settlement shall be taken up during the concrete placing operation. They shall be securely braced against lateral deflections. Provide mud sills when supporting shoring off the ground.

G. Forms for exposed finished surfaces shall be fabricated with new "concrete form" plywood sheathing or other approved materials. Fabricate wood forms for unexposed surfaces of sound lumber sheathing or plywood sheathing or approved pre-fabricated forms.

H. The contact surface of wall forms for concrete exposed to view shall be smooth faced plywood sheathing. Full sized sheets of plywood shall be used to ensure close fitting and tight joints. All vertical joints shall be backed solidly, and the edges of abutting sheets shall be nailed to the same stud. Suitable moldings or chamfer strips shall be placed in the corners of wall forms where the concrete will be exposed to view.

I. For concrete surfaces exposed to view, the deflection of facing materials shall be not greater than 1/360 of the span.

Studs and wales shall never be less than 2"x4" and greater as required. All wales shall be staggered at least the spacing of the form ties. Vertical kick strips shall be used at the intersection of the walls at all exterior corners and the corners shall be tightly wedged to prevent leakage. Under no conditions shall studs be spaced more than 12 inches on centers, and when used with plywood sheathing having the grain of the outer plies parallel to the studs, the stud spacing shall be reduced 2 inches. Wales shall be spaced not more than 24 inches centers and ties shall be spaced not more than 27 inches centers when used with double 2"x4" wales. Where a lift of forms is 10 feet or more high, double 2"x6" vertical wales spaced not more than 10 feet centers and extending the full height of the forms, shall be bolted to every other set of horizontal wales to maintain the forms in straight, and true alignment. Provide diagonal bracing to hold forms in vertical alignment.

J. Inside surfaces of wood board forms shall be soaked with clean water and kept continuously wet for such periods as approved by the Contracting Officer before concrete is placed. Plywood forms shall be treated with form oil. Remove surplus oil on form surfaces and all oil from reinforcement before placing concrete. In cold weather with freezing temperatures a probability, oiling only will be permitted.

3-2 FORMWORK TOLERANCES:

A. General Requirements Relative to Tolerances: Forms shall be set and maintained so as to insure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed any of the tolerances hereinafter called for. Variations in floor levels shall be measured before removal of supporting shores. The variations permitted for horizontal and vertical building lines and for placement of footings shall not permit encroachment of a building beyond its legal boundaries. The tolerances specified shall not be exceeded by any portion of any concrete surfaces; the specified variation for one element of the structure shall not be applicable when it will permit another element to exceed it allowable variations.

B. Form Tolerances: Shall be in accordance with ACI 347, Section 203.1 (reproduced herein) with the additional requirements called for under sub-paragraph 1c, 2c, 4a, 4b, 8a, and 8c.

1. Variation from plumb of vertical lines:

a. In the lines and surfaces of columns, piers, walls, and in arrises:

In 10 feet--------------------------1/4 inch
In any story or 20 feet maximum-----3/8 inch
In 40 feet or more------------------3/4 inch

b. For exposed corner columns, control-joint grooves, and other conspicuous lines:

In any bay or 20 feet maximum-------1/4 inch
In 40 feet or more------------------1/2 inch

c. For any two successive intermediate points on line or surface separated by:

10 feet-----------------------------1/8 inch
20 feet or more---------------------1/4 inch

2. Variation from the levels or grades indicated:

a. Floors*, ceilings, beam soffits, and in arrises:

In 10 feet--------------------------1/4 inch
In any bay or 20 feet maximum-------3/8 inch
In 40 feet or more------------------3/4 inch

3. Variations of the lineal building lines from established position indicated and related position of columns, walls and partitions:

In any part or 20 feet maximum------1/2 inch
In 40 feet or more------------------1 inch

*Variations in floor level are to be measured before removal of supporting shores; the Contractor is not responsible for variations due to deflection except when the latter are corrobratory evidence of interior concrete quality or curing, in which case only the net variation due to deflection can be considered.

4. Variations in the sizes and locations indicated of:

a. Sleeves, pits, floor and wall openings----------------------------1/2 inch

b. Anchor bolts or anchor bolt clusters----------------------------1/4 inch

5. Variation in dimension of beams, columns, slabs and walls from those indicated:

a. Beams and columns depth and width-------------------------------minus 1/4 inch

b. Slabs and walls thickness-------

Less than 6 inches------------------minus 0, plus 1/4 inch
6 inches or more--------------------minus 1/4 inch, plus 1/2 inch

6. Variation in rise and tread of steps from those indicated:

a. For a flight of stairs:

Rise--------------------------------1/8 inch
Tread-------------------------------1/4 inch

b. For consecutive steps:

Rise--------------------------------1/16 inch
Tread-------------------------------1/8 inch

7. Variation of vertical dimension from position indicated:

a. Over-all building dimension-----1/2 inch

b. Over-all story height, as limited by following intermediate dimensions but not to exceed--------1/2 inch

c. Intermediate dimensions:

Less than 10 feet-------------------1/4 inch

3-3 REMOVAL OF FORMS:

Formwork for walls, sides of beams, girders, and other parts not supporting the weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal operations.

Formwork for beam soffits, supported slabs, and other parts that support the weight of concrete shall remain in place until the concrete shall have reached its specified 28 day strength.

When shores and other vertical supports are so arranged that the form facing material may be removed without loosening or disturbing the shores and supports, the facing material may be removed at any earlier age as permitted by the Contracting Officer. The shores and supports shall remain in place until the concrete has reached its 28 day strength.

Whenever the formwork is removed during the curing period, the exposed concrete shall be cured by one of the methods specified under "Curing Concrete".

3-4 SHORING:

When reshoring is required the operations shall be planned in advance and shall be subject to the review of the Contracting Officer.

Reshoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support their own weight. While reshoring is under way, no live loads shall be permitted on new construction. Reshores shall be lightened to carry their required loads but they shall not be over-tightened so that the new construction is over stressed. Reshores shall remain in place until the concrete has reached its specified 28 day strength.

3-5 CONCRETE STRENGTH BEFORE FORM REMOVAL:

When form work removal or reshoring is based on the concrete reaching its specified 28 day strength, the concrete shall be presumed to have reached this strength when either of the following conditions have been met.

A. When test cylinders, field cured under the most favorable conditions for any portion of the concrete represented, has reached the required strength. Except the field curing and age at test, the cylinders shall be molded and tested as specified under "Tests for Concrete".

B. When concrete has been cured as specified under "Curing Concrete" for the same length of time as the age of test of laboratory cured cylinders which reach the required strength. The length of time the concrete has been cured in the field shall be determined by the cumulative hours or fractions thereof, not necessarily consecutive, during which the temperatures of the air in contact with the concrete is above 50 degrees Fahrenheit, and the concrete has been damp or thoroughly sealed from evaporation or loss of moisture.

3-6 FILLING TIE ROD OR BOLT-HOLES:

Holes left by bolts or tie-rods shall be filled solid within 12 hours after removal of forms with cement mortar blended to match adjacent surface. All tie holes shall be cleaned of excessive oils by a swab and appropriate solvent. Holes passing entirely through wall shall be filled from inside face with a device that will force the mortar through the wall to the outside face, using a stop held at the outside wall surface to insure complete filling. Other holes shall be packed full to the surface of the concrete. Excess mortar on face of filled holes shall be struck off and the mortar finished to blend with the adjacent surface.

3-7 REMOVAL OF DEFECTIVE CONCRETE:

After forms have been removed, any concrete which is not formed as indicated on drawings, or which is out of alignment of level beyond required tolerances or which shows a defective surface which cannot be properly repaired or patched shall be removed and replaced without cost to the Government.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and placing concrete reinforcement as shown on the contract drawings and the approved detail shop drawings. Included in this section of work are steel bar reinforcement and welded steel wire fabric reinforcement.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cast-in-place Concrete - Section 03300.

1-3 QUALITY ASSURANCE: Reference., American Concrete Institute (A.C.I.) ACI 301 Article 5.2, and Concrete Reinforcing Steel Institute (CRSI).

1-4 MATERIALS HANDLING:

A. Marking: Finished work shall be shipped to the job neatly bundled and clearly and securely tagged with marks corresponding to those used on placing diagrams. Marks shall be machine pressed or embossed on zinc tags wired to bundles.

B. Storage at Job Site: Reinforcing and bars shall be sorted at the job and stored on racks clear of the ground, systematically arranged in the order of their use. Bars for other than immediate use shall be protected from the weather and from dirt, grease, etc.

C. Cleaning: Before placing, reinforcement shall be cleaned thoroughly of loose rust, mill scale, and coatings including form-oil and ice, that would reduce or destroy bond. Do not use reinforcement reduced in section. Following any substantial delay in the work, inspect and clean previously placed reinforcement left for future bonding. Do not bend or straighten reinforcement in manner injurious to the materials. Do not place bars with kinks or bends not indicated on the drawings.

1-5 FABRICATING AND PLACING TOLERANCES:

A. Bars used for concrete reinforcement shall meet the following requirements for fabricated tolerances:

1. Sheared Length: plus or minus one inch

2. Depth of truss bars: plus 0 minus 1/2 inch

3. Stirrups, ties, and spirals:	plus or minus 1/2 inch
4. All other bends:	plus or minus 1 inch

B. Bars shall be placed to the following tolerances:

1. Concrete cover to formed surfaces	plus or minus 1/4 inch
2. Lengthwise positioning of bars	plus or minus 2 inches
3. Spacing bars in walls and solid slabs	plus or minus 1 inch
4. Spacing bars in joists, beams and footings	minus 0 inch plus 1/4 inch
5. Top bars in slabs and beams	
a. Members 8 inch deep or less	minus 0 inch; plus 1/4 inch
b. Members 8 to 24 inches deep	plus or minus 1/2 inch

C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to approval.

1-6 SUBMITTALS: Submit shop drawings and certificates (See Section 01300).

PART 2: MATERIALS

2-1 REINFORCING MATERIALS:

A. Main bar reinforcement shall have a minimum yield point strength of 50,000 psi and meet requirements of current ASTM specifications as follows:

A-15 Billet-steel bars for concrete reinforcement - hard grade.

A-16 Rail steel bars for concrete reinforcement. (To be used only where reinforcement does not require bending).

A-408 Special large size deformed billet-steel bars of deformed steel bars for concrete reinforcement.

A-305 Minimum requirements for the deformations of deformed steel bars for concrete reinforcement.

B. Stirrups, ties and spirals only may be billet-steel intermediate grade, having a minimum yield point strength of 40,000 psi.

C. All bar and fabric reinforcement shall be free from rust, scale, paint or coating of any character which will tend to prevent proper bonding of the concrete.

D. Mesh reinforcement shall conform to the requirements of the Specifications for Welded Steel Wire Fabric for Concrete Reinforcement current ASTM Designation A-185.

E. All bars shall be the full weight called for according to size.

F. Metal accessories shall include spacers, chairs, ties and other devices necessary for properly spacing, supporting and fastening reinforcement in place. In all instances, where slabs or walls are exposed to view as exterior surfaces, plastic tipped or stainless steel spacers, bolsters, chairs, etc., shall be used for supports.

PART 3: EXECUTION

3-1 REINFORCEMENT INSTALLATION:

A. References: Details of concrete reinforcement not covered herein shall be in accordance with ACI 318, "Building Code Requirements for Reinforced Concrete" and ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures".

B. Supports: Reinforcing bars shall be supported and secured together to prevent displacement by construction loads or the placing of wet concrete beyond the tolerances specified in Section 03210, part 1-5.

1. Supports: With the exception of temperature reinforcement which shall be tied to the main stall approximately 24 inches on centers, reinforcement shall be accurately tied at all intersections greater than 12 inch centers and minimum of two ties at all intersections greater than 12 inch centers and a minimum of two ties at splices with 16 gauge black annealed wire and shall be securely held in position during the placing of concrete by spacers, chairs or other approved

supports. Wire-tie ends shall point away from the form. Except as otherwise indicated on the drawings or specified, the number, type and spacing of supports shall conform to the ACI Detail Manual (ACI 315).

a. Bars for slabs to be placed directly on grade shall be supported on precast concrete brick or chairs with plates spaced at intervals as required by the size of the reinforcement used to keep the reinforcement the minimum height specified below the top side of the concrete to be placed.

b. Where welded wire fabric is placed in slabs on grade, concrete brick shall be placed with #4 or #5 reinforcing bars placed at 3 foot or 4 foot spacings respectively to provide the proper support and positioning method of support subject to approval of the Contracting Officer.

C. Protection of Reinforcement: Concrete protection for reinforcement shall be as follows, except as otherwise noted on the plans.

1. Footings and other principal structural members deposited against the ground: 3 inches.

2. Concrete surfaces after removal of forms which are to be exposed to weather or be in contact with the ground or water; 2 inches for bars larger than #5, and 1-1/2 inches for #5 bars and smaller.

3. Concrete surfaces not exposed to the weather or in contact with the ground; 3/4 inch for slabs and walls; 1-1/2 inches for beams and columns; and 3/4 inch for pan joist floors.

4. In no case shall concrete protective cover be less than the diameter of the bar.

D. Splices: All splices not indicated on drawings must be approved by the Contracting Officer.

E. Bending: Reinforcement shall not be bent after partially embedded in hardened concrete.

F. Welding: Shall be in accordance with ACI 318, Section 805, latest revision.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of supplying and installing expansion and contraction joints in concrete work as shown on the drawings, and at the intersection of floor slabs and exterior walls, at wood post concrete piers and as detailed on the drawings. Included in this section of work is the installation of filler materials and joint sealers.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cast-in-place Concrete-Section 03300.

1-3 QUALITY ASSURANCE: References - American Concrete Institute (A.C.I.); American Society for Testing and Materials (ASTM), Federal Specifications.

PART 2: MATERIALS

2-1 JOINT FILLER STRIPS: a. Shall be pre-molded, non-extruding type, 1/2 inch thick and of full depth, conforming to Federal Specifications HH-F-341, Type 1, Class B.

b. Expansion joint fillers shall be preformed composition asphalt, vegetable fiber and mineral fiber formed between 2 sheets of asphalt saturated felt. Joint fillers shall be 1/2" thick x depth of slab. Material shall conform to ASTM-D 994 and Federal Specification HH-F-341, Type III.

2-2 JOINT SEALER: Shall be cold application type conforming to ASTM D-1850, or hot poured elastic type, conforming to ASTM D-1854.

2-3 COMPATIBILITY: The compatibility of joint sealer and joint filler materials shall be thoroughly tested before application.

PART 3: EXECUTION

3-1 EXPANSION JOINTS: Install expansion joints only where indicated on the drawings.

3-2 REINFORCEMENT: Reinforcement or other embedded metal items bonded to the concrete, shall not be permitted to extend continuously through any contraction or expansion joint, except dowels in slabs bonded on only one side of the joint and wrapped with felt paper on the other side of the joint.

3-3 FILLER STRIPS: Pre-molded joint filler strips shall be installed the full slab thickness, less 1/2 inch. Hold joint fill down below finish surface and fill void with joint sealer. Joints shall be slightly underfilled to prevent extrusion of sealer; any excess material shall be removed as soon after sealing as possible.

If frost heaving is possible which could cause an offset of the joint the joint shall be keyed or have dowels as described above under 3-2 Reinforcement.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of setting in place the bond beam anchor bolts, the wood column post bases, and the chainlink fence post sleeves.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Anchor bolts - Section 05501; Post Bases - Section 06115.

PART 2: MATERIALS

Fence post inserts shall be galvanized steel as per the fence manufacturer's instructions.

PART 3: EXECUTION

Accurately set and securely brace anchor bolts in bond beam grout and post bases for wood columns in concrete piers.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and placing of waterstops in concrete work as shown on the drawings. Included in this section of work are installation of waterstops in the secondary confinement tanks.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cast-in-place Concrete-Section 03300; Expansion and Contraction Joints - Section 03251.

1-3 QUALITY ASSURANCE: References - American Concrete Institute (ACI), American Society for Testing Materials (ASTM), Corps of Engineers CRD-C 572.

PART 2: MATERIALS

The waterstop shall be the ribbed PVC type.

Construction and Contraction Joints	6" strip type
Expansion Joints	9" large bulb

The waterstop shall be extruded from virgin polyvinyl chloride resin plastic with the following properties:

All waterstop shall meet or exceed all of the requirements set forth in the U.S. Corps of Engineers Specifications (CRD-C 572) latest revision.

PART 3: EXECUTION

Splicing one section of waterstop to another shall be made by pressing the pieces to be joined against a metal plate heated to 420 degrees Fahrenheit plus or minus 15 degress Fahrenheit. The heated pieces shall then be immediately pressed together while still soft and held together until cool. Speed is important at this point. The same technique shall be used in making all T's, crosses, X's and other fittings required. All splices and special connection pieces shall be spliced in a manner such that any cross-sections shall be dense, homogeneous and free of all porosity. All finished splices shall have a tensile strength of not less than 75% of the unspliced material. All waterstop shall be installed so that half of the width of the waterstop shall be embedded on one side of the joint and half on the other and be centrally located in the concrete. In cases where preformed expansion joint material is used in conjunction with the waterstop, allowance shall be made so that equal waterstop embedment is attained on both sides. All joints required to be watertight shall be formed with extreme care. The concrete shall be carefully vibrated or puddled so as to be completely consolidated around the waterstop. The manufacturer's installation instructions shall be followed.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and applying the concrete leakproofing where shown on the drawings and as specified herein. The type of material shall form an integral part of the concrete after application.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cast-in-place Concrete-Section 03300; Expansion and Contraction Joints - Section 03251; Waterstop - Section 03253.

1-3 QUALITY ASSURANCE: Reference, Manufacturer's Recommendations.

1-4 TESTING: Before acceptance, the Contractor shall demonstrate that the leakproofing is satisfactory by applying water to the waterproofed surface. For the fuel storage containment structures, fill the containment area with water and monitor the structure for a period of 48 hours. If, after that time, leakage is not evident, the work will be deemed acceptable. Should leakage exist, repairs will be made immediately and the structure subjected to another test.

1-5 MATERIAL TESTING: The materials, when used to treat concrete, shall have been tested to prevent leakage under a pressure of greater than 5 atmospheres. The concrete treatment shall be non-reactive with petroleum hydrocarbons.

PART 2: MATERIALS

2-1 CONTAINMENT STRUCTURE LEAKPROOFING: Materials used for leakproofing of the concrete containment areas shown on the drawings shall be specifically formulated to prevent liquids from penetrating into and through concrete. The product shall be of a cementitious capillary bonding type. They shall be available in powder form and capable of application in a slurry form. Components of the material shall include high quality cement and treated fine quartz with a mixture of inorganic and organic chemicals. The concrete leakproofing shall be Vandex or approved and tested equal.

PART 3: EXECUTION

3-1 APPLICATION: Apply leakproofing material at the rates and in the manner recommended by the manufacturer. Also, surface preparation, finishing and curing shall be in accordance with manufacturer's recommendations.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of the work consists of mixing, conveying, placing, finishing and curing cast-in-place concrete as shown on the drawings and as specified herein.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Earthwork - Section 02200; Concrete Formwork - Section 03100; Concrete Reinforcing Steel - Section 03210; Expansion and Contraction Joints - Section 03251; Waterstop - Section 03253; Wire Anchors and Inserts - Section 03252, and Floor Treatment - Section 09760.

1-3 QUALITY ASSURANCE: References - American Concrete Institute (ACI); American Society for Testing and Materials (ASTM); Portland Cement Association (PCA).

1-4 TESTS FOR CONCRETE:

A. General: Routine testing of materials, of proposed concrete mix designs and of resulting concrete for compliance with technical requirements of these specifications will be the duty of a testing laboratory engaged and paid for by the Contractor, subject to approval by the Contracting Officer. These tests are strictly for the information of the Contracting Officer. The Contractor shall secure and pay for such additional tests as he may require to guarantee performance of the concrete work under this contract.

The concrete mix design and the testing and laboratory work in connection therewith shall be accomplished by the Contractor and testing laboratory for this purpose selected and paid for by the Contractor.

Testing of field cured test cylinders or testing required because of changes in concrete mix ingredients or proportions of the concrete mix or materials occasioned by their failure to meet specification requirements, shall be at the Contractor's expense.

B. Testing Laboratory: Responsibilities

1. Test the Contractor's proposed materials for compliance with the specifications.

2. Provide concrete mix designs as specified under "Proportioning of Concrete Mixes".

2. Provide concrete mix designs as specified under "Proportioning of Concrete Mixes".

3. Secure production samples of materials at ready-mix concrete plant during the course of the work and test for compliance with the specifications.

4. Conduct strength tests of the concrete in accordance with the following procedures:

a. Secure composite sample from the same batch in accordance with ASTM C-172, "Method of Sampling Fresh Concrete".

b. Mold six specimens for each sample in accordance with ASTM C-31, "Method of Making and Curing Concrete Compression and Flexure Specimens in the Field" and cure under standard moisture and temperature conditions in accordance with Section 7 a and 7 b of the above ASTM Method.

c. Test specimens shall be divided into 3 sets of 2 specimens each. Two specimens shall be tested at 7 days, 2 specimens shall be tested in 28 days, and the remaining 2 specimens shall be retained in reserve for retesting if required. Each specimen shall be marked with an identifying number. Tests shall be in accordance with ASTM C-39, "Method of Test for Compressive Strength of Molded Concrete Cylinders".

d. Make one strength test for each 150 cubic yards or fraction thereof for any class of concrete placed on any one day, except that in no case shall a given class be represented by less than 5 tests.

e. In addition to the above, test specimens shall be tested for entrained air content in accordance with ASTM C-173, "Method of Test of Air Content of Freshly Mixed Concrete by the Volumetric Method", or ASTM C-231, "Method of Test of Air Content of Freshly Mixed Concrete by the same Pressure Method".

f. Temperature of concrete samples, ambient temperature at site, and slump shall also be determined and recorded.

5. Report in writing all test results to the Contracting Officer and the Contractor on the same day that tests are made, also to any other parties designated by the Contracting Officer.

6. Reports for strength tests shall contain the date of placement, date of test, name of job, mix proportions, W/C ratio, slump location of batch in the structure, type of

concrete and the breaking strength in psi and type of break, air temperature and concrete temperature.

C. Authority and Duties of Testing Laboratory:

1. Representatives of the testing laboratory shall inspect the materials and the manufacture of concrete and shall report their findings to the Contracting Officer and the Contractor. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing laboratory representative shall direct the attention of the Contracting Officer and the Contractor to such failure.

2. The representatives of the testing laboratory shall not act as foreman or perform other duties for the Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Contracting Officer for final acceptance. Representatives of the testing laboratory are not authorized to revoke, alter, relax, enlarge, or release any requirement of the specifications, nor to approve or accept any portion of the work.

D. Responsibilities and Duties of the Contractor:

1. The use of testing laboratory shall in no way relieve the Contractor of his responsibility to furnish materials nad construction in full compliance with the drawings and specifications.

2. To facilitate the testing laboratory, the Contractor shall:

a. Secure and deliver to the testing laboratory, without cost preliminary representative samples of the materials he proposes to use and which are required to be tested.

b. Submit through the testing laboratory to the Contracting Officer each concrete mix design he proposes to use, and make written request for acceptance. (See Section 01300.)

c. Furnish such casual labor as is necessary to obtain and handle samples at the project or other sources of material.

d. Advise the testing laboratory sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

e. Provide and maintain for the sole use of the testing laboratory adequate facilities for safe storage, and proper curing of concrete test cylinders on the project site for the first 24 hours as required by ASTM C-31.

E. Evaluation of Tests Results:

Strengths of concrete shall be considered satisfactory if the average of any five consecutive strength tests of the laboratory cured specimens representing each strength of concrete called for under "Classes of Concrete and Uses" is equal to or greater than the specified strength; and if not more than 20 percent of the strength tests have values less than the specified strength.

F. Failure to Meet Strength Requirements:

1. If strength tests fail to meet the minimum strength requirements specified in Section 03300, part 2-5 D, the concrete represented by such tests shall be considered questionable and shall be subjected to further testing at the expense of the Contractor.

2. Additional tests of questionable concrete shall be done by the testing laboratory at the expense of the Contractor in accordance with ASTM C-42, "Method of Securing, Preparing and Testing Specimens for Hardened Concrete for Compressive and Flexural Strengths".

3. Additional tests of the hardened concrete may be required by the Contracting Officer even though the above requirements Section 03300, part 2-5 D are met when, in his opinion, there is cause for concern over the adequacy of the structure. The Contractor shall not be required to bear the cost of such tests unless their results confirm that the concrete in place is deficient.

4. If core tests fail to demonstrate strengths adequate for the intended purpose of the member or members in question, as determined by the Contracting Officer or if the failure to meet specified strength requirements occurred in members from which it is impracticable to secure test specimens by the Method of ASTM C-42, load tests shall be conducted and their results evaluated in accordance with Chapter 2 of ACI 318, "Building Code Requirements for Reinforced Concrete".

PART 2: MATERIALS

2-1 PORTLAND CEMENT:

A. Portland Cement shall conform to the current "Specifications for Portland Cement" ASTM Designation C-150 and shall be Type I or Type II.

B. The Contractor shall furnish the Contracting Officer with certified mill test reports for the cement to be used in the work. (See Section 01300.)

C. Cement awaiting use shall be stored off the ground on dry platforms, in a dry, weathertight, and properly ventilated structure, with adequate provisions for the prevention of absorption of moisture.

D. At any time before its use in the work, cement shall not have developed any "warehouse pack" or if so be freed of same by rolling, and shall be entirely free from lumps. Cement salvaged by cleaning sacks, mechanically or otherwise, or from discarded sacks of cement, shall not be used in the work. If the temperature of the cement at the time of delivery to the mixer exceeds 165 degrees Fahrenheit, it may be required to be stored until cooled to that temperature.

E. Only one brand of American made cement may be used throughout the work.

2-2 AGGREGATE FOR CONCRETE:

A. Coarse Aggregate:

1. Coarse aggregate shall consist of crushed stone, gravel, or other approved inert material with similar characteristics or a combination thereof, having clean, hard, durable, uncoated particles free from deleterious matter, and conforming to ASTM C-33 except where higher requirements are specified herein. Any materials which would affect the bonding characteristics of the cement paste are to be considered "deleterious".

2. Unloading and stockpiling of aggregates shall be performed in such manner as to avoid separation of the different sizes of aggregate or the mixing of different aggregates. Stockpiling of aggregates too high, or allowing aggregates to fall too great a distance shall be avoided. If the storage and handling of the aggregate causes separation, the concrete pro-

ducer shall stockpile separately the different sizes and shall provide the required equipment to insure the batching of the proper qualities, by weight, of the different sizes of aggregate. All aggregate sent to the mixer shall have the approved aggregate gradation. Care must be taken to preserve gradation and cleanliness of the aggregate.

3. Deleterious substances shall not be present in the aggregates in excess of the following amounts.

a.	Soft and non-durable particles	2% max.
b.	Chert (defined as having a specific gravity of less than 2.35 - ASTM C-33)	1% max.
c.	Hard absorbent particles	2% max.
d.	Total, including hard absorbent not to exceed	4% max.

4. Grading Requirements for Coarse Aggregate:

a. One inch to No. 4 (ASTM C-33, Size No. 57) for concrete walls more than 5 inches thick; columns and beams having minimum section dimension more than 5 inches; reinforced slabs more than 4 inches in thickness; and all lightly or unreinforced slabs and similar concrete sections. Note: one inch is maximum size aggregate to be used.

b. Three-fourths inch to No. 4 (ASTM C-33), Size No. 67) for concrete walls less than 5 inches thick; columns and beams having minimum section dimension less than 5 inches; heavily reinforced slabs less than 4 inches in thickness and similar thin concrete sections.

c. One-half inch to No. 4 (ASTM C-33, Size No. 7) for concrete fill in treads and platforms of steel stairs having metal pans.

d. The foregoing A to C are general grading requirements; and it shall be noted that regardless of such general requirements the following requirement shall not be exceeded:

"The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between sides of the forms of the member for which the concrete is to be used no larger than three-fourths of the minimum clear spacing between individual reinforcing bars or groups of bars".

B. FINE AGGREGATE:

1. Fine aggregate shall consist of sand, either natural or manufactured, having clean, hard, durable, uncoated grains, free from deleterious substances and shall range in size from fine to coarse within the following percentages by weight; shall conform to ASTM C-33; and at the time of use shall be free from crusts of hard or frozen material.

Passing	3/8"	sieve....100 percent
Passing No.	4	sieve.... 95-100 percent
Passing No.	8	sieve.... 80-100 percent
Passing No.	16	sieve.... 50- 85 percent
Passing No.	30	sieve.... 25- 60 percent
Passing No.	50	sieve.... 10- 30 percent
Passing No.	100	sieve.... 2- 10 percent
Loss by washing		....................not more than 3

2. The above gradation represents the extreme limits which shall determine suitability for use from all sources of supply. The gradation from any one source shall be reasonably uniform and not subject to the extreme percentages of gradation specified above. For the purpose of determining the degree of uniformity, a fineness modulus determination will be made upon representative samples from any source. Fine aggregate from any source having a variation in fineness modulus greater than 0.20 either way from the fineness modulus of the representative sample will be rejected.

C. Soundness: The fine and coarse aggregates when subjected to five alternations of the sodium sulfate soundness test (ASTM C-88) shall not show an average weighted loss of more than 10 percent for the fine aggregate and 12 percent for the coarse aggregate, unless evidence satisfactory to the Contracting Officer is furnished that concrete of comparable proportions in which similar materials from the same sources were used has given satisfactory service when exposed to conditions similar to that to be encountered.

D. Furnish samples of all aggregates as often as directed for laboratory sampling, testing and sieve analysis.

2-3 ADMIXTURES:

A. Air Entraining Admixture - ASTM C-260 shall govern.

B. Water Reducing Admixture - ASTM C-494 shall govern.

1. Water reducing admixtures may be used subject to successful performance of same in a trial mix and if the Contracting Officer so approves.

2. When temperature of air is less than 40 degrees Fahrenheit, use water reducing and accelerating admixture conforming to ASTM C-494 Type E.

3. When temperature of air is between 40 and 65 degress Fahrenheit, use water reducing and accelerating admixture conforming to ASTM C-494 Type A.

4. When temperature of air exceeds 65 degrees Fahrenheit a water reducing and retarding admixture conforming to ASTM C-494, Type C may be used.

5. Statement of Conformance: Before ordering any admixtures submit a statement of conformance to the above ASTM Specifications and the name of the product proposed for use to the Contracting Officer for approval.

2-4 MIXING WATER:

A. Water used for mixing concrete shall be clean and potable, free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that are deleterious to concrete or steel.

B. Water shall preferably be taken from mains of the utility and shall be maintained clean and free from contamination.

C. In the event it is ever necessary to use non-potable water, same may be used only if it produces mortar cubes having 7 and 28 day strengths equal to the strength of similar specimens made with distilled water, when tested in accordance with "Method of Test for Compressive Strength of Hydraulic Cement Mortars" (ASTM C-109).

D. Note: In computing the water content for concrete, any surface water contained in the aggregate must be included.

2-5 PROPORTIONING CONCRETE MIXES:

A. General: The proportioning of concrete ingredients shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the work, but without permitting the materials to segregate or to cause excessive free water to collect on the surface.

B. Method of Proportioning Aggregate: Fine and coarse aggregates shall be proportioned by direct weight upon suitable weighing devices, designed and constructed for this purpose. Weighing equipment shall permit making compensation for changes in the weight of moisture contained in the aggregates. Weighing equipment shall be accurate to within one percent of the net load being weighed. Water shall be measured by an approved device capable of accurate measurement to 1 percent of the total amount of water required per batch. Total water includes free surface moisture in the aggregate and any other liquids added to the concrete mix.

C. Mix Design: Determination of proportions of cement, aggregates, admixtures, and water to attain required concrete strengths shall be established by trial mixes made in advance of beginning of operations, and in accordance with the following.

1. Concrete trial mixes having proportions and consistency suitable for the work shall be made using at least three different water-cement ratios (not to exceed W/C ratios listed under Table I "Limits for Proportions of Concrete Made From Average Materials") which will produce a range of strengths encompassing those required for the work. Trial mixes shall be designed to produce the maximum allowable slump.

2. Proportions of ingredients shall be determined and tests conducted in accordance with the basic relations and procedures outlined in ACI 613 "Recommended Practice for Selecting Proportions for Concrete" using water cement ratios nor more than, nor cement contents not less than the limits called for under Table I, "Limits for Proportions of Concrete Made From Average Materials".

3. For each water-cement ratio, for each class of concrete, at least 3 specimens shall be made for age to be made and cured in accordance with ASTM C-192, "Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory" and tested for compressive strength at 7 and 28 days. Tests shall be conducted in accordance with ASTM C-39 "Method of Test for Compressive Strength of Molded Concrete Cylinders".

4. From the results of the above tests a curve shall be plotted showing the relationships between water-cement ratios and compressive strengths. The maximum permissible water-cement ratio shall be that value not exceeding the W/C ratio

called for under Table I shown by the curve to produce a strength minimum not less than that specified for concrete classes less than 4000 psi and a strength minimum greater than 15 percent than the strength specified for concrete classes 4000 psi and over. Should the tests show consistently higher strengths than those specified, this requirement will be met. Under no circumstances shall the maximum water-cement ratio or the minimum cement content be changed beyond the limits called for under "Concrete and Uses" because of consistently higher strength test results.

5. Submit written report of each concrete mix design and tests for acceptance and approval.

6. Slump of concrete for each kind of construction as determined by current ASTM C-143 "Method of Test for Slump of Portland Cement Concrete" shall be as follows:

Kind of Construction	Slump in Inches*	
	Maximum	Minimum
Mass Concrete	6	2
Slabs, beams, reinforced walls	5	2
Building columns	5	3

*When high frequency vibrators are not used, slump values may be increased up to 50 percent, but in no case shall slump exceed 6 inches. Minimum slump shall be waived for concrete used in ramps and other sloping construction.

D. Classes of Concrete and Usage:

1. General: Concrete shall be of the class as herein specified unless more specifically designated on detailed construction drawings. Class shall be designated by 28 day compressive strength and whether or not it is air entrained.

2. Mass Concrete: Class 2500 mass concrete shall be Class 2500A and shall be used for all concrete not reinforced including thrust blocking and concrete fill for hydraulic structures.

3. Footing Concrete: Class 3000 footing concrete shall be Class 3000A.

4. Structural Concrete Class 3750:

a. General concrete work, including all steel reinforced structural elements of buildings, tanks, and appurtenant structures, slabs on grade and sidewalks.

b. Water tight concrete; for tanks, reservoirs, and other structures for water containment shall meet the requirements of PCA Bulletin ST-33 for mix proportions and construction joints.

TABLE I - Limits for Proportions of Concrete Made From Average Materials

Class of Concrete (Required 28 Day Compressive Strength)	Maximum Water/Cement Ratio			Minimum Cement Content (per Cu.Yd)	
	U.S. Gal. per 94 lb. Bag of Cement	Decimal lb. Water per lb. Cement	Aggregate Size	Bags	Wt. in lbs.
2500 psi	8	.71	3/4"	4-3/4	446.5
			1"	4-1/2	423.0
			1-1/2"	4-1/4	399.5
3000 psi	7-1/2	0.66	3/4"	5-1/2	517
			1"	5-1/4	494
			1-1/2"	5	470
3750 psi	6-1/2	0.58	3/4"	6-1/2	611
			1"	6	564
			1-1/2"	5-3/4	541
4000 psi	6	0.53	3/4"	6-1/4	588
			1"	6	564
			1-1/2"	5-3/4	541
5000 psi	5-1/2	0.49	3/4"	7	658
			1"	6-1/2	611
			1-1/2"	6	564

Note: This Table indicates the limits for the concrete mixtures. It is not intended as a mixture design and does not supersede or eliminate the requirements for trial mixes. The trial mixtures will establish the exact proportions for all the materials for the concrete to be used on this project.

E. AIR ENTRAINMENT:

1. For all exposed concrete surfaces where freezing and thawing may be encountered during construction or service lift, the use of air-entrained concrete is mandatory.

2. Air-entraining cement (conforming to current ASTM C-175) or an air entraining admixture (conforming to ASTM C-260) shall be used to obtain proper air content as called for by Table II.

3. Air content shall be determined by current ASTM C-173 "Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method" or current ASTM C-231 "Method of Test of Air Content of Freshly Mixed Concrete by the Pressure Method", and shall be as follows:

TABLE II

Type of Concrete	Nominal Aggregate Size	Air Content % by Volume
Exposed (Standard Exposed Concrete)	1/2"	8% - 9%
	3/4"	7% - 8%
	1"	6% - 7%
	1-1/2"	5% - 6%
Unexposed* (Structural Concrete, Standard Floor Concrete, Standard Foundation Concrete)		3% - 4%

*Note: Structural type concrete subject to exposure shall contain entrained air. It does, however, require a special consideration in that the total air content may vary from that indicated for standard exposed concrete in Table II above.

PART 3: EXECUTION

3-1 CONCRETE SLABS ON GRADE:

A. Preparation for Placing: Water shall be removed from excavation before concrete is deposited. Any flow of water shall be diverted through proper side drains and shall be removed without washing over freshly deposited concrete. Hardened concrete, debris and foreign materials shall be removed from interior of forms and from inner surfaces of mixing and conveying equipment. Reinforcement shall be secure in position, inspected and approved before pouring of concrete. Runways shall be provided for wheeled concrete handling equipment; such equipment shall not be wheeled over reinforcement nor shall runways be supported on reinforcement.

B. Compacted Granular Sub-Base: Provide compacted granular sub-base under the floor slab of buildings and structures as required on the plans. Material shall be well graded, maximum size 1 inch; not over 10 percent by weight shall pass the No. 8 sieve. Thickness as shown on the drawings.

Before placing sub-base, clean surfaces thoroughly removing all trash. Do not place sub-base on frost, snow, ice, mud or in water. Compact with mechanical tamps or other approved method. Top of sub-base shall be smooth and dense at time when concrete is placed.

After the sub-base has been installed to required grade, the vapor barrier shall be installed for all building floor slabs prior to the placement of reinforcement and concrete.

C. Vapor Sheet: Vapor barrier sheet shall be installed directly beneath all building slabs on the finished sub-base. The vapor barrier shall be plastic having a minimum weight of 6 mils and sufficient strength to prevent puncturing by workmen or sub-base material. The entire area shall be covered, using sheets as wide as possible to avoid joints, which shall be lapped 6 inches and sealed in accordance with manufacturer's recommendations.

D. Granular Protection Sheet: Shall be installed under slabs not requiring a vapor barrier sheet, of all structures utilizing a special granular drainage material to function as a medium to allow groundwater to flow to drains or relief valves. Granular protection sheet shall be applied over the area with edge laps of 6 inches. The sheet shall have sufficient strength to prevent puncturing by the granular material.

3-2 FOOTINGS AND FOUNDATIONS: Concrete footings shall be placed upon firm, level, undisturbed clean surfaces, free from frost, ice, mud, water or other deleterious materials as soon as possible after excavations have been completed. Over excavation shall be filled with concrete of the same class as the footing. If bearing capacity of soil is questionable, Contractor shall notify the Engineer before placing concrete. All concrete shall be placed continuously from bottom to top; when the foundation is on dry soil or pervious material, waterproof sheathing paper shall be laid over surface to receive concrete.

3-3 CONCRETE WALLS: Foundation walls, enclosing walls and other walls shown to be of concrete shall be built to dimensions shown and shall be finished true and level on top for reception of floors, walls, etc. Walls enclosing excavated parts shall be well braced and bracing is to be kept in place until concrete floors are poured and set.

3-4 CONCRETE CURING:

A. General: Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures, and shall be maintained without drying at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. Changes in temperature of the concrete shall be as uniform as possible and shall not exceed 5 degrees Fahrenheit in any one hour, or 50 degrees Fahrenheit in any 24 hour period.

B. Initial Curing: Initial curing shall immediately follow the finishing operation. Concrete shall be kept continuously moist at least 24 hours. Curing shall be accomplished by any of the following methods, where applicable to the type of work involved:

1. Waterproof paper - ASTM C-171, Type 1.

2. Mats - commercial quality of a type used for the purpose.

3. Burlap - commercial quality.

4. Membrane curing compound - ASTM C-309. (Not to be used where concrete will be leakproofed.)

5. Polyethylene sheet, shall be white, free from physical defects, and not less than 0.004 inches thick. The sheet shall have a moisture loss of no more than 0.055 grams per square cm as determined by ASTM C-156.

C. Final Curing: Immediately following the initial curing and before the concrete has dried, additional curing shall be accomplished by one of the following methods:

1. Continuing the method used in initial curing.

2. By covering surface with waterproof paper.

The final curing shall continue until the cumulative number of hours or fractions therof, during which temperature of the air in contact with the concrete is above 50 degrees Fahrenheit has totaled 168 hours. Rapid drying at the end of the curing period shall be prevented.

Steel forms heated by the sun and all wood forms in contact with the concrete during the final curing period shall be kept wet. If forms are removed during the curing period, one of the curing methods specified above shall be employed immediately, and shall be continued for the remainder of the curing period. During damp periods, maintain water curing routine except use only amount of water necessary to keep forms or covering moist.

D. Liquid Membrane Curing: Apply sprayed on membrane curing compound as soon as surface water has disappeared from concrete surfaces. Apply curing compound with approved pressure spraying equipment in accordance with manufacturer's instruction, in sufficient thickness and uniform coverage as required to form effective moisture seal. Curing compounds shall not be used in surfaces against which additional concrete or any other cementitious finishing materials are to be bonded, nor on surfaces which are to receive liquid hardener, resilient flooring or leakproofing treatment.

3-5 CONVEYING AND PLACING CONCRETE:

A. Concrete Equipment and Labor Requirements: All machinery and equipment owned or controlled by the Contractor which is proposed to be employed by him on the work shall be of sufficient size to meet the requirements of the work, and shall be such as to produce a satisfactory quality of work. The Contractor shall employ at all times a sufficient force of workmen, of such experience and ability that the work can be executed in a satisfactory and workmanlike manner.

B. Preparation for Placing Concrete:

1. Before placing concrete, hardened concrete debris, ice and other foreign materials shall be removed from the inner surfaces of the conveying equipment, and from form interiors, and reinforcement. All conveyances, buggies, or barrows shall be thoroughly cleaned at frequent intervals during the placing of the concrete.

2. Oil wood forms, or except in freezing weather, thoroughly wet before pouring concrete so that all joints will tighten sufficiently to prevent cement grout seepage from mix. Secure reinforcement in position and have same inspected and approved before pouring concrete.

3. Provide runways or other means for wheeled equipment to convey concrete to deposit points. Do not wheel equipment used to deposit concrete over reinforcement and do not support runways on reinforcement.

C. Method of Placing: Concrete shall be handled from mixer to transport vehicle to place of final deposit in a continuous manner, as rapidly as possible, and without segregation or loss of ingredients until the given operational unit is completed. Do not deposit concrete that has attained its initial set or has contained its water content for the time limit specified under "Transit Mixed Concrete" nor splash forms or reinforcement with concrete before pouring. Deposit concrete in forms as nearly as practical in final position, to avoid rehandling. Immediately after depositing, compact concrete by agitating thoroughly in an approved manner, to force out air pockets. Work mixture into corners, around reinforcement and inserts, in a manner to prevent formation of voids. Tapping or other external vibration of forms will not be permitted. Do not permit concrete to drop freely over 5 feet, nor shall concrete be deposited in large quantities at one point and then run or worked along forms.

D. Pneumatic Placing: Where concrete is conveyed and placed by pneumatic means the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the place of deposit. The position of the discharge end of the line shall not be more than 10 feet from the point of deposit. The discharge lines shall be horizontal or inclined upwards from the machine.

At the conclusion of placement, the entire equipment shall be thoroughly cleaned.

Pumping: Where concrete is conveyed and placed by mechanically applied pressure the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned. Where drops greater than 5 feet are necessary, a tremie or other approved method shall be used. The discharge of the tremies shall be controlled so that the concrete may be effectively compacted into horizontal layers not more than 12 inches thick, and the spacing of tremies shall be such that segregation does not occur. Concrete to receive other construction shall be screeded to proper level to avoid excessive skinning or grouting.

E. Consolidation:

1. General: Place concrete in layers not over 12 inches deep, and compact each layer by mechanical internal vibrating equipment supplemented by hand spading, rodding and tamping. Do not use vibrators to transport concrete inside forms. Use of form vibrators will not be permitted. Internal vibrators shall be of sturdy construction adequately powered and capable of transmitting to the concrete not less than 5,000 impulses per minute when submerged in concrete.

2. Duration of Vibration: Limit vibration duration, to time necessary to produce satisfactory consolidation without causing objectionable segregation at least 20 seconds per square foot of exposed surface. Do not insert vibrator into lower courses that have begun to set. Apply vibrators at uniformly spaced points not further apart than visible effectiveness of machine.

F. Bonding: Before depositing new concrete on or against concrete that has set, the existing surfaces shall be thoroughly roughened and cleaned free of laitance, foreign matter and loose particles. Forms shall be retightened and existing surfaces shall be prepared as specified.

G. Cold Weather Requirements: Concrete, when deposited in cold weather, shall be at a temperature not less than 50 degrees Fahrenheit, and not more than 70 degrees Fahrenheit. In freezing weather, suitable means shall be provided for maintaining the concrete at a temperature not lower than 70 degrees Fahrenheit, for three days, or 50 degrees Fahrenheit five days after placing, except when high early strength

Portland Cement or concrete is used in which case the temperature must be maintained at not less than 70 degrees Fahrenheit, for two days or 50 degrees Fahrenheit for three days. Cooling of the concrete to outside temperature shall be at a rate not exceeding one degree per hour for the first day after completion of curing and 2 degrees per hour thereafter, until the outside temperature is reached.

Details and methods of heating and materials and protecting the concrete shall be in accordance with the procedures in "Recommended Practice for Winter Concreting" (ACI 604).

H. Hot Weather Requirements:

1. It is vital that concrete is protected from heat and premature drying out before, during and after placing.

2. During mixing, placing and curing, concrete temperatures shall be maintained at less than 90 degrees Fahrenheit. To reduce the concrete temperature, ice may be used in the mixing water in quantities up to 50 percent of the specified water, provided that all of the ice be melted when mixing is complete. Cement shall not be used during hot weather that is at a temperature higher than 170 degrees Fahrenheit. Care shall be taken during batching to prevent formation of cement balls. Aggregate may be cooled by shading, spraying or by other approved means.

3. Special care must be taken when using Type III cement. No retempering of concrete shall be permitted. No water shall be added to improve workability. Proper scheduling of concrete deliveries to the forms is essential to keep mixing time at a minimum and to prevent placement delays resulting in unplanned or undesirable cold joints.

4. Details and methods of placing and handling concrete shall be in accordance with the procedures in "Recommended Practice for Hot Weather Concreting (ACI 605).

I. Construction Joints:

1. Construction joints are to be used at a temporary stopping of concrete placement.

2. Joints not indicated on the drawings shall be made and located so as not to impair significantly the strength of the structure. Joints at places of maximum shear shall be avoided and if impractical, they shall be keyed in. Where a joint

is to be made, the surface of the concrete shall be thoroughly cleaned and all laitance removed. In addition to the foregoing, vertical joints shall be thoroughly wetted and slushed with a coat of neat-cement grout immediately before placing on new concrete.

3. A delay, at least until the concrete is no longer plastic, must occur in columns or walls before concreting beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered part of the floor system and shall be placed monolithically with them.

4. Construction joints in floors shall be located near the middle of the span of slabs, beams, or girders; however, if a beam intersects a girder at the midpoint, the joint in the girder shall be offset a distance equal to twice the width of the beam. Provision shall be made for transfer of shear and other forces through the construction joint.by installing a key.

5. Waterstops shall be placed across all joints where leakage is possible and undesirable.

3-6 CONCRETE FINISHING:

A. Finishing Exposed Surfaces: Concrete surfaces exposed to view, except in rough entirety unfinished spaces, shall have a smooth finish produced on green concrete. All necessary patching shall be done immediately after forms have been removed and rubbing shall be completed not later than the following date. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until a uniform color and texture are produced. No cement grout or slush shall be used other than the cement paste drawn from the green concrete itself by the rubbing process.

B. Finishing Concealed Concrete Surfaces: Concrete surfaces of rough, entirely unfinished spaces, ceiling slabs, with suspended ceilings below, and other formed surfaces not exposed to view shall have rough or board finish. After removal of forms, tie holes and defects shall be patched.

C. Floor Slab and Other Flatwork Finishes:

1. Selection of Finishes: Applicable floor slab and other flatwork finishes shall be used as follows:

a. Scratched Finish: For floors indicated on drawings to receive ceramic tile, separate topping, or other bonded applied cementitious applications.

b. Floated Finish: For roof slabs and preliminary finish to other finishes as specified hereinafter.

c. Troweled Finish: For floors indicated on drawings to receive resilient flooring, liquid hardener and the like.

d. Separate Topping: For fill in treads and platforms of metal pan steel stairs.

2. Finishing Methods:

a. Scratched Finish: After concrete floor slab has been placed, struck-off, consolidated and leveled the surface shall be roughened with stiff brushes or raked before final set.

b. Floated Finish: After the concrete floor slab has been placed, struck-off, consolidated and leveled, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared, and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-driven floats of the impact type except in thin sections such as pan slabs. Hand floating with wood or cork-faced floats shall be used in locations inaccessible to the power-driven machine. Trueness of surfaces shall be rechecked at this stage with a 10 foot straight edge applied at not less than two different angles. All high spots shall be cut down and low spots filled during this procedure to produce planes checking true under the straight edge in any direction, with tolerances not exceeding 1/8 inch in 10 feet. The slab shall then be refloated immediately to a uniform smooth, granular surface.

c. Troweled Finish: The surface shall be floated finish as specified above, then with power trowels, and finally with hand trowels. The first troweling after floated finish shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but which may still contain some surface which is relatively free of defects but which may still contain some trowel marks. Additional troweling shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operation.

The finished surface shall be free of any trowel marks and shall be uniform in texture and appearances. On surfaces intended to receive resilient flooring, any defects of sufficient magnitude to show through the resilient flooring shall be removed by grinding.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work in this section consists of the furnishing and installing of Substructure Concrete Placed Under Water (S.C.P.U.W.) for the water intake encasement as specified herein and as shown on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Marine Work Intake - Section 02900; and Concrete - Division 3.

1-3 QUALITY ASSURANCE: Michigan Department of State Highways and Transportation (MDSH&T), Standard Specifications for Highway Construction.

PART 2: MATERIALS

Materials shall conform with Article 5.03. 10(C) of the Standard Specifications for Highway Construction MDSH&T.

PART 3: EXECUTION

S.C.P.U.W. is intended to be an integral part of the Substructure Concrete (Grade 35S) placed immediately above and in contact with this material. The S.C.P.U.W. (Grade 35T) will be placed to an elevation 12 inches above an approved water level. The Contractor shall then stop placing any additional concrete, remove all water inside the forms and then continue the pour with Substructure Concrete (Grade 35S). The delay between the two types of concrete for removing water shall not exceed 45 minutes, and the integration of the two types of concrete shall be accomplished by vibratory equipment.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing grout as specified herein and as shown on the drawings. This section of work includes preparing and filling the buried gasoline tanks at Mott Island with grout, sealing of pipes and openings where shown on the drawings.

1-2 QUALITY ASSURANCE: References, American Society for Testing and Materials (ASTM), Michigan Flammable Liquids Regulations.

1-3 RELATED WORK SPECIFIED ELSEWHERE: Reinforcing Steel - Section 03210; Cast-In-Place Concrete - Section 03300; Concrete Unit Masonry - Section 04220; Anchor Bolts - Section 05501 and Post Bases - Section 06115.

PART 2: MATERIALS

2-1 GROUT MATERIALS: Materials for use in grout shall comply with the requirements of ASTM C-476.

2-2 ADMIXTURES: Do not use calcium chloride in grout to be used in filling the buried gasoline tanks at Mott Island, or in other places where grout will be in contact with reinforcement, metal ties, anchors, or piping.

2-3 NON-SHRINK GROUT: Non-shrink grouting for post (column) bases shall be performed using Master Builders Embeco Grout (pre-mixed) or equal.

2-4 GROUT MIX PROPORTIONS: Grout to be used for filling the buried gasoline tanks at Mott Island shall have the following mix proportions:

	Cement	Hydrated Lime	Fine Aggregate
Parts by Volume	1	0 to 0.1	3

Grout to be used for other purposes shall conform to the mix proportions presented in ASTM C-476.

2-5 STRENGTH: All grout shall have a minimum compressive strength of 2500 psi at 28 days.

PART 3: EXECUTION

3-1 GROUTING OF BURIED GASOLINE TANKS: Prepare the buried gasoline tanks and appurtenances at Mott Island in accordance with the Michigan Flammable Liquids Regulations. Pump grout into tanks and fill them until grout begins to escape from vents. Upon filling the tanks, seal each tank in accordance with the Michigan Flammable Liquids Regulations, 1973.

3-2 GROUTING, MISCELLANEOUS: Install grout as shown on the drawings, in a manner appropriate for the specific application.

3-3 NON-SHRINK GROUT: Non-shrink grout shall be installed in strict accordance with manufacturer's directions and specifications.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and placing mortar for concrete unit masonry.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Concrete Unit Masonry - Section 04220.

1-3 SUBMITTALS: Submit certificates. (See Section 01300.)

PART 2: MATERIALS

2-1 MATERIALS: Mortar for unit masonry shall be Type M and shall be in accordance with ASTM C270. Component materials shall be in compliance with the following:

Masonry Cement, ASTM C91, Type ll.

Sand for mortar shall conform to ASTM C144.

Mixing water shall be clean and free from oil, acids, alkali or organic matter.

2-2 STRENGTH: All mortar shall have a minimum compressive strength of 2500 p.s.i. at 28 days. Brands of cement and the source of supply of sand shall remain the same throughout the entire job and shall not be changed except by written permission of the Contracting Officer. Insofar as possible, the same laborer shall be assigned to mortar mixing throughout the project.

2-3 COLOR: Mortar used with split-fluted decorative concrete unit masonry shall be of color to match units.

PART 3: EXECUTION

3-1 MIXING MORTAR: Mix all cementitious materials and sand in a mechanical batch mixer for a minimum of 5 minutes. Adjust the consistency of the mortar to the satisfaction of the mason but add only as much water as is compatible with convenience in using the mortar. If the mortar begins to stiffen from evaporation or from absorption of a part of the mixing water, retemper the mortar immediately by adding water and remix the mortar. All mortar shall be used within 2-1/2 hours of the initial mixing. It shall not be used after it has begun to set.

3-2 PLACEMENT: Refer to Section 04220.

END

PART 1: GENERAL

The work of this Section consists of providing and placing steel joint reinforcement in concrete unit masonry walls and partitions.

PART 2: MATERIALS

Steel reinforcement for use in horizontal bed joints of concrete masonry units shall be prefabricated type formed of cold drawn steel wire conforming to ASTM specification A82. Side wires shall be formed of no. 9 gauge or larger and be deformed, cross rods shall be of 9 gauge or larger, smooth or deformed wire, butt welded to side wires in the same place at contact points and spaced not more than 16 inches apart. Provide special formed pieces at corners and intersections of walls or partitions. Reinforcing shall be equal to AA Wire Products Co., Standard "Blok-Trus" #T.S. 8.

PART 3: EXECUTION

Install joint reinforcement in all masonry partitions and walls. Place continuously at vertical spacing of 16" o.c. except where specifically noted otherwise on drawings. Immediately before placing, reinforcement shall be free of loose rust or other foreign coatings that will reduce bond. Reinforcement for openings shall extend 36 inches beyond each side of opening and occur in first three courses above each opening.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing all concrete unit masonry as detailed.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Mortar - Section 04100; Joint Reinforcement - Section 04160.

1-3 PRODUCT HANDLING: Store concrete masonry units under cover in a dry place in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store concrete masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Concrete masonry units shall be protected against wetting prior to use.

1-4 SUBMITTALS: Submit certificates. (See Section 01300.)

PART 2: MATERIALS

2-1 UNIT TYPES: Concrete unit masonry types shall conform to the applicable ASTM specifications for the locations and usages listed following:

A. Interior Partitions - C129, Grade N, Type 1 hollow non load-bearing units. Nominal 8" x 16" face x nominal 8" depth.

B. Exterior and Foundation Walls (Except Split-Fluted Decorative Units) - C90, Grade N, Type 1 hollow load-bearing units. Nominal 8" x 16" face x nominal 8" depth.

C. Exterior Walls above Grade Where Detailed - Type 1 hollow load bearing, scored units. Nominal 8" x 16" face x nominal 8" depth. Scored masonry units shall be furnished in standard masonry beige color.

D. Bond Beams Where Detailed - C90, Grade N, Type 1, nominal 8" x 16" face x nominal 8" depth bond beam units.

2-2 SPECIAL UNIT DEPTHS: Where required or detailed provide 4" nominal depth concrete masonry units of matching type.

2-3 MATERIALS: All concrete masonry units shall be normal weight hollow units complying with the following requirements:

A. Units shall be made from portland cement, water and suitable mineral aggregates with or without the inclusion of other suitable materials.

1. Cementitious material shall conform to the following specifications:
Portland Cement (ASTM C 150)
Air-Entrained Portland Cement (ASTM C 175)
Portland Blast Furnace Slag Cement (ASTM C 205)
Portland Pozzolan Cement (ASTM C 340)
Hydrated Line (ASTM C 207) (Type S only)
Fly Ash (ASTM C 350)

2. Other constituents (air-entrained agents, coloring pigments or integral water repellents) shall be previously established as suitable for use in concrete, and shall either conform to ASTM standards where applicable, or shall be shown by test or experience not to be detrimental to the durability of concrete.

3. Aggregates shall conform to ASTM C-33.

B. Minimum compressive strength (average gross area) shall be:

1000 p.s.i. - average of 5 units.
800 p.s.i. - individual unit.

C. Moisture content of units at the time of delivery and use shall not exceed 35% of total absorption.

D. Minimum face shell thickness of units shall be 1-1/4". Minimum web thickness shall be 1" (average of 5 units at thinnest point).

PART 3: EXECUTION

3-1 WORKMANSHIP:

A. All masonry walls shall be laid true to line with jointing level and of uniform thickness. Corners shall be plumb and square All units above grade shall be laid in stacked bond. All units below grade shall be laid in running bond pattern with the units in the course above regularly breaking joints with the course below.

B. Mortar joints between units shall be 3/8" thick with full mortar coverage on vertical and horizontal face shells only, except the first course shall be laid on the footing in a full mortar bed. Vertical joints shall be shoved tight. Each unit shall be adjusted to its final position in the wall while the mortar is still plastic. Any unit which is disturbed after the mortar has stiffened shall be removed and relaid with fresh mortar.

C. Mortar joints which are to be exposed or painted shall be struck off flush with the wall surface and when the mortar is partially set, shall be firmly compacted with a round pointing tool. Mortar joints in the face of walls to be paneled shall be struck off flush with the face of the wall. Exterior mortar joints on split-fluted block shall be flush with the block face and shall be flush with the projected face of the decorative flutes.

D. Units shall not be wetted prior to use.

E. Where fresh masonry joins masonry that is partially set or totally set, clean the exposed surface of the set masonry and wet it lightly so as to obtain the best possible bond with the new work. Remove all loose mortar.

F. Consult all trades and make provisions that will permit the installation of their work in a manner to avoid cutting and patching. Build in work specified under other divisions, as necessary, and as the work progresses.

G. Set steel lintels in beds of mortar. Fill spaces around jambs and heads of metal door bucks and frames, solidly with mortar. Build-in anchors and clips for windows. Set joint reinforcement as specified and detailed.

H. Fill bond beams with 3000 p.s.i. concrete and reinforcement as indicated. Reinforcement shall be continuous around corners.

3-2 PROTECTION: When work is discontinued, the tops of all walls shall be protected by a well-secured waterproof cover.

3-3 COLD WEATHER

A. No masonry work shall be permitted when the temperature is less than 32 deg. F. or below 40 deg. F. and falling, unless the following precautions are taken:

1. Below 40 deg. F., but above 32 deg. F.:

Heat mortar mixing water, but not above 160 deg. F. Mortar when placed shall be between 70 deg. F. and 100 deg. F. Plastic sheets or tarpaulins shall be placed over the newly laid walls.

2. Below freezing, but above 0 deg. F.:

In addition to the preceding requirements, sand shall be heated, but not scorched. The working area shall be enclosed with protective coverings and artificial heat shall be provided. When the temperature falls below 20 deg. F. all concrete masonry units shall be heated to at least 50 deg. F. at the job site by the contractor.

3. Below 0 deg. F.:

Construction shall be stopped unless the enclosure is complete and tight. Observe all preceding requirements.

B. Masonry shall be protected against freezing for at least 48 hours.

C. No masonry shall be laid with or on frozen materials.

3-4 POINTING AND CLEANING MASONRY: Point all holes in exposed masonry. Cut out defective joints and repoint with mortar. Process work in as clean a manner as possible and remove excess materials and mortar droppings daily. After the mortar joints have been tooled, mortar burrs shall be removed by rubbing with burlap or carpet.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing structural steel double-angle lintels at masonry openings. Refer to lintel schedule on drawings.

1-2 SUBMITTALS: Submit Shop Drawings fully describing all structural steel detailed or scheduled for the project. (See Section 01300.)

PART 2: MATERIALS

Structural steel shall conform to ASTM, A36.

PART 3: EXECUTION

3-1 WORKMANSHIP: Work shall be made and erected square, plumb, straight and true. Welds shall be finished flush and smooth on surfaces that will be exposed after installation. Metal surfaces shall be clean and free from all scale, flake, rust and rust pitting. Weld permanent connections. Joints exposed to weather shall be formed to exclude water. Work shall conform to the applicable provisions of the AISC and AWS.

3-2 ERECTION: Deliver to masonry trade, for setting in masonry, all items which are to be built into the work. All work shall be installed level or plumb and in correct line. Work shall be substantially fixed in place so as to be rigid and secure and to resist all loads and stresses to which the work may normally be subjected.

3-3 SHOP PAINTING AND TOUCH-UP:
A. Preparation - All metal surfaces shall be thoroughly clean and free of loose mill scale, rust, dirt, weld flux, weld spatter and other foreign matter.

B. Shop Painting - Shop paint shall be of red lead iron oxide type paint. All steel members, except galvanized items, machined surfaces, surfaces which are to be welded and surfaces to be encased in concrete shall be painted before shipping. Surfaces inaccessible after assembly shall be given 2 coats of paint. Finish shop coats shall be smooth and even and where field painting is required, final shop coat shall be suitable for the application of finish paint.

C. Touch-Up - After erection of all metal items required herein, touch-up all welds and abrasions with same type paint used in the shop coat.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing and installing the bond beam anchor bolts as detailed on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Anchors and Inserts - Section 03252.

PART 2: MATERIALS

Anchor bolts shall conform to ASTM A-307.

PART 3: EXECUTION

None

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of the furnishing and installation of the pipe and tube railings for the water treatment plant.

1-2 SUBMITTALS: Submit certificates. (See Section 01300.)

PART 2: MATERIALS

Railings shall be fabricated of components manufactured by Julius Blum & Company or approved equal. Component shown shall be in accordance with the manufacturers recommendations.

Railings and posts shall be fabricated of extruded aluminum. Thickness of wall shall be .109" or greater.

Fasteners shall be aluminum, stainless steel, selected to meet the corrosion exposure of the particular fastening conditions.

Alloys:

(A) Extrusions shall be alloy 6063-T5 2 or proper alloy for specified finish.

(B) Castings shall be alloy 214.

Finishes:

(A) All exposed aluminum will have a brushed texture finish in accordance with the Aluminum Association Designation AA-M-35.

(B) Welds completely dressed and blended to pipe.

(C) All aluminum waxed with paste wax.

Components:

(A) Size of rail 1-1/2" IPS) or rail No. 423.

(B) Handrail molding shall be No. 6901.

(C) Accessories:

(1) Wall mounting bracket #313.

(2) Post bracket #312.

(3) Post mounting device #421.

PART 3: EXECUTION

Contractor shall store, handle and install materials with every precaution to avoid damage and shall maintain protection until final acceptance of the building.

All components shall be installed with posts plumb and rails true to line, at designated location(s) and in accordance with approved shop drawings. Anchorage shall be rigid with all mechanical fasteners drawn up tight.

As late in the construction period as practical Contractor shall thoroughly clean all components using mild soap and water or by other methods recommended by the manufacturer.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing all framing, wood posts, wood beams, plywood roof sheathing, wood furring, plates, bracing, grounds and blocking.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Post Bases and Caps - Section 06115.

1-3 JOB CONDITIONS:
A. Scaffolding - Contractor shall provide properly erected scaffolding as required. All standard rules pertaining to safety shall be observed.

B. Protection of Work - Contractor shall provide all necessary protection of sills, corners, door jambs, floors, windows and finished materials. He shall also provide all temporary closures required.

PART 2: MATERIALS

2-1 MATERIALS:
A. Framing lumber, wood posts and wood beams shall be Select Structural Douglas Fir or No. 1 Southern Pine, free from large or loose knots, dried to a moisture content of 19% or less and shall be straight and not warped.

B. Plywood roof sheathing shall be exterior grade, Group 1, DFPA Plywood.

C. Wood furring, blocking and plates shall be Structural Douglas Fir or No. 2 Southern Pine, dried to a moisture content of 19% or less and shall be straight and not warped.

2-2 TREATMENT: All material used for furring,plates, blocking and grounds shall have a certified field-applied coating of wood preservative. This shall be equal to U.S. Plywood "Wood-Life" or Pentachlorophenal.

PART 3: EXECUTION

All materials shall be installed in full compliance with recommendations of the American Institute of Timber Construction and the American Plywood Association.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing all Post Bases and Caps.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Anchors and Inserts - Section 03252; Grout - Section 03600.

PART 2: MATERIAL

2-1 POST BASES: These shall be equal to Simpson Company, Model #CB 88 column bases.

2-2 POST CAPS: These shall be equal to Simpson Company, Model #CC 88 column caps.

PART 3: EXECUTION

Set post bases in concrete and grout as detailed. Connections to wood members shall be by through-bolts as shown.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing restroom, interior and exterior trim, and exterior paneling (including clg. and soffits).

1-2 SUBMITTALS: Submit minimum 2'-0" x 2'-0" samples of exterior "APA-303" paneling (siding). Submit shop drawings fully describing restroom counters. (See Section 01300.)

1-3 RELATED WORK SPECIFIED ELSEWHERE: Framing and Sheathing - Section 06110.

PART 2: MATERIALS

2-1 COUNTERS: Framing materials shall comply with requirements for framing lumber, Section 06110. Plywood shall comply with requirements for plywood roof sheathing, Section 06110. Plastic laminate shall be equal to Formica or Wilson Art 0.062" laminated plastic, General Purpose Grade - 10.

2-2 TRIM: Interior and exterior trim members shall be WWPA Appearance Grade, C Select Douglas Fir, Larch or Southern Pine.

2-3 EXTERIOR PANELING: Exterior paneling (siding) shall be APA 303, 5/8" W.P. Redwood or Cedar siding, rough sawn and kerfed at 4" o.c.

PART 3: EXECUTION

3-1 COUNTERS: Construct these as detailed. Aprons and backsplashes shall be self edged with plastic laminate.

3-2 TRIM: Install as detailed. Surfaces shall be smooth sanded to receive finish painting.

3-3 PANELING: Exterior paneling shall be installed as detailed. Exterior paneling (siding) shall be installed over furring as noted.

END

RT 1: GENERAL

-1 DESCRIPTION: The work of this Section consists of providing
nd installing or applying Bituminous Dampproofing, Silicone Damp-
roofing and Plastic Vapor Barrier.

-2 SUBMITTALS: Submit certificates. (See Section 01300.)

RT 2: MATERIALS

-1 BITUMINOUS DAMPPROOFING: All exterior walls below grade
all receive mastic dampproofing equal to Sonneborn "Hydrocide Spray
stic".

-2 SILICONE DAMPPROOFING: All exterior exposed decorative con-
ete unit masonry shall receive Silicone Masonry Coating (Clear)
ual to O'Brien's "Seal-Dry".

-3 PLASTIC VAPOR BARRIER: Under-slab plastic vapor barrier shall
0.006" Polyethylene Film.

RT 3: EXECUTION

-1 BITUMINOUS DAMPPROOFING: On all exterior walls below grade,
detailed, apply a heavy sprayed-on coat of mastic dampproofing
a minimum thickness of 1/8". Apply in full compliance with
nufacturer's instructions.

-2 SILICONE DAMPPROOFING: On all exterior exposed decorative
ncrete unit masonry apply two coats of Silicone Masonry Coat-
g. First coat shall be thoroughly dry prior to application
second coat.

-3 PLASTIC VAPOR BARRIER: Under all interior slabs on grade
stall one ply plastic vapor barrier. Barrier shall be applied
one unbroken sheet for the full width and length of each
om.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing and installing cedar shake roofing complete with underlayment and metal edge drip.

1-2 SUBMITTALS: Submit cedar shake sample.

PART 2: MATERIALS

2-1 SHAKES: Shakes shall be equal to Koppers, U/L Class "C" fire retardent treated Red Cedar shakes. Shakes shall be hand split, No. 1 Blue Label, 24" x 3/4" x 1-1/4", 350 lbs./sq. Underlayment shall be as recommended by manufacturer.

2-2 METAL EDGE DRIP: Metal edge drip shall be "Color-Klad" 24 ga. copper clad zinc grip base with "Duranar #200", 20 year guaranteed of "Mansard Brown" color.

PART 3: EXECUTION

Installation, underlayment, flashing and nailing shall be in full compliance with manufacturer's directions for roof pitch noted.

END

PART 1: GENERAL

The work of this Section consists of providing and installing sill and lintel flashing.

PART 2: MATERIALS

Flashing material shall be AFCO, WASCO, Sandell, Revere, or approved equal; 2 ounce copper reinforced Sisal-Kraft Sheet.

PART 3: EXECUTION

Install flashing under all window sills and over lintels for north and south window openings.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing and installing sealants and caulking.

1-2 SUBMITTALS: Submit certificates. (See Section 01300.)

PART 2: MATERIALS

2-1 EXTERIOR SEALANTS: Exterior caulking material shall be approved equal to Dow #790, General Electric "Silicone Construction Sealant" or Pecora #862 Silicone Sealant with Dow Chemical "Ethafoam" backer rod.

2-2 INTERIOR CAULKING: Interior caulking material shall be equal to ADCO Mfg. Co. Acrylic Latex Sealant.

PART 3: EXECUTION

2-1 EXTERIOR SEALANTS: Exterior caulking shall be installed over backer rod in full compliance with manufacturer's directions at all exterior door frames, windows and all other open joints between adjoining materials exposed to the weather.

2-2 INTERIOR CAULKING: Interior caulking shall be installed in full compliance with manufacturer's directions at door frames and windows.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing hollow metal doors and frames.

1-2 RELATED WORK SPECIFIED ELSEWHERE : Finish Hardware - Section 08710; Glazing Plastics - Section 08840.

1-3 SUBMITTALS: Submit shop drawings fully describing all doors and frames detailed and scheduled for the project. (See Sec. 01300.)

PART 2: MATERIALS

2-1 MANUFACTURER: Doors and frames shall be comparable to those manufactured by Fenestra, Steelcraft, Pioneer, Superior, Republic Steel, CECO or Trussbilt. Other manufacturers may be submitted for consideration.

2-2 HOLLOW METAL DOORS: Doors shall be 1-3/4" thick of rigid construction with full flush panel design .. faces shall be constructed of 16 gauge cold rolled, leveled steel sheets with seamless unbroken lines. Interior grid shall be manufacturer's standard with sound deadening provision. All doors shall be mortised and reinforced for locks and hinges, per approved hardware schedule, with minimum of 14 gauge elements attached by multiple welds. Required doors shall be reinforced for closers with minimum 12 gauge plate. Doors shall have flush top and bottom. Finish shall be manufacturer's standard baked-on primer.

2-3 HOLLOW METAL FRAMES: Door frames shall be formed of 14 U.S. Gauge. Frames shall be shop fabricated and assembled with corners welded, mitered and ground. Frames shall be reinforced for all hardware required with 1/4" steel reinforcements (Drilled and tapped as required) and protected with welded steel plaster guards. Hinges shall be template, 4-1/2" x 4-1/2", furnished by hardware vendor. Strike jambs shall be provided with cutout for strike plate and reinforced. Rubber bumpers shall be provided in stops. Three (3) each side and one (1) floor anchor each side shall be provided for each jamb and shall be suitable for type of construction as required. Anchors shall be insertable in the field. All frames with door closers shall have head rail reinforced with 12 gauge x 18" long section of configuration similar to door frame and designed for sliding in place prior to assembly. All jambs shall have factory prime coat of paint and upon arrival at job site shall receive one field coat of red lead and oil primer (this shall not be considered part of specified finish painting).

2-4 HARDWARE: Seamless and full flush doors shall be prepared to receive 4-1/2" x 4-1/2" full mortise hinges and locksets.

Note that some doors require reinforcing for closers.

Hardware Vendor shall furnish and Contractor shall install properly all finish hardware so that it operates easily. Rebates shall be by Door Manufacturer. Refer to Section 08710.

205 GLAZING: Door manufacturer shall provide glazing openings as shown complete with glass light mouldings of zinc coated steel with no exposed screws on exterior side of door. Refer to Section 08840.

PART 3: EXECUTION

Doors shall be stored out of weather in upright position until placed in openings. After door placement, remove temporary spreader at bottom of door frame.

Frames shall be set in position, plumbed and securely braced until permanent anchors are set. See special requirements for field painting with red lead (Par. 2-3 above).

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing pre-glazed wood awning windows as detailed and scheduled.

1-2 SUBMITTALS: Submit Shop Drawings fully describing all windows required for the project. (See Section 01300.)

1-3 RELATED WORK SPECIFIED ELSEWHERE: Glazing Plastics - Section 08840.

PART 2: MATERIALS

Wood windows shall be equal to Pella Wood Awning Windows as manufactured by Rolscreen Company, Pella, Iowa, with the following to apply:

Frame - Toxic water-repellent preservative treated Western Pine with all exterior surfaces primed. Completely assembled with operating hardware. Overall width of frame to be 4-3/8".

Sash - Genuine Western Pine, 1-3/4" thick, toxic water-repellent preservative treated, with all exterior surfaces primed. Corners mortised and tenoned, glued and nailed.

Glazing - 3/16" Glazing plastic. Refer to Section 08840.

Weatherstripping -Flexible polyvinyl chloride material, in exclusive Dual Durometer Design, is compressed between frame and sash for positive seal on all four sides.

Hardware - All-steel worm-gear sash operator with hardened gears. Draw-in compound-action heavy-gauge plated steel operator arm. Cam-action sash lock at sill, one installed on sash.

Sash operator crank and lock finished in baked bronze enamel.

Screen - Gray-painted aluminum screen cloth set in bronze-tone aluminum frame and supplied complete with all necessary hardware.

Assembly - Individual units shall be furnished factory assembled with sash installed in the frame.

PART 3: EXECUTION

Install in full compliance with manufacturer's directions.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of the furnishing of the finish hardware required for the project by the Hardware Vendor. Contractor shall install all finish hardware.

1-2 SUBMITTALS: Submit hardware schedule fully describing all finish hardware required for the project. (See Section 01300.)

1-3 RELATED WORK SPECIFIED ELSEWHERE: Hollow Metal Doors and Frames - Section 08110.

PART 2: MATERIALS

2-1 MANUFACTURER: Hardware furnished shall be as manufactured by (other manufacturers may be submitted for consideration):

Hinges: Stanley, Hager, McKinney
Locksets - Sargent, Yale, Russwin, Corbin
Closers - LCN, Sargent, Norton
Kickplates - Baldwin Mfr.
Doorstops - Sargent, Glynn-Johnson

2-2 HARDWARE GROUPS: Hardware groups shall be as follows:

GROUP 1

Lockset - Government Type 87 G Mortise Public Entrance lockset (double cylinder function). Equal to Sargent #7816. Trim to include cold-forged escutcheon 8" h. x 2-1/2" w. with 2-1/4" dia. cast knobs. Equal to Sargent HMR design.

Hinges - Government Series FF-H-116D, Type T 2112 hinge. Equal to Stanley F-BB 199, 4-1/2" x 4-1/2". 1-1/2 pairs required per door.

Closer - Equal to Sargent 150 Series, Model #EN 154-0.

Kickplates - Shall be 16 B&S ga. (0.050") Stainless Steel, US 32 D finish, 10" h. x 34" w., on both sides of each door.

Door Stop - Government Series FF-H-111a, Type 1326. Equal to Sargent #3424. Exception: No door stop shall be provided for laundry room.

GROUP 2

Lockset - Government Type 87 EW Mortise Service lockset. Equal to Sargent #7804. Trim - same as specified for Group 1 lockset.

Hinges - As specified for Group 1.

Closer - None required.

Kickplates - As specified for Group 1. Exception: No kickplate shall be provided for inside face of door to Mechanical Room.

Door Stop - As specified for Group 1.

2-3 FINISH: All hardware, except kickplates as above noted, shall be furnished in US-26D finish.

2-4 KEYING: All locksets shall be master keyed in one group. Furnish 6 master keys and 4 individual keys for each lockset.

PART 3: EXECUTION

3-1 DELIVERY: All hardware shall be delivered to site in unopened cartons clearly marked for the opening in which it is to be installed.

3-2 INSTALLATION: All hardware shall be installed in full compliance with manufacturer's instructions.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing all glazing plastics for windows and hollow metal doors. Window glazing shall be by wood window manufacturer but shall comply with this Section of the Specifications.

1-2 SUBMITTALS: Submit samples of glazing plastic specified. Samples shall be not less than 4" x 4". (See Section 01300.)

1-3 RELATED WORK SPECIFIED ELSEWHERE: Hollow Metal Doors and Frames - Section 08110; Wood Windows - Section 08610.

PART 2: MATERIALS

Glazing plastic shall be 3/16" Lexan MR-4000, 9038-112 Clear Translucent Polycarbonate Sheet as manufactured by the General Electric Company, or approved equal.

Glazing plastic shall comply with a Combustion Classification of CC-1 by BOCA.

PART 3: EXECUTION

Glazing plastic shall be installed in full compliance with manufacturer's instructions including those regarding glazing compounds, edge clearances and final cleaning.

END

SECTION 09450 CEILING SUSPENSION SYSTEM

PART 1: DESCRIPTION

1-1 The work of this section includes the furnishing and installation of all lay-in acoustical units and suspension system including wire hangers, main tee runners, cross ties, angle molding and hold down clips where required.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Lighting Fixtures - Section 16510.

1-3 QUALITY ASSURANCE: BOCA Code, Manufacturer's printed instructions and Federal Specification SS-S-118A, ASTM-84, rating 0-25.

PART 2: MATERIALS

2-1 Suspended ceiling system shall be exposed grid system with components formed from commercial-quality cold-rolled steel, and pre-painted.

2-2 Acoustical units shall be 2' x 4', 5/8-inch thick lay-in type units. Units shall have a Flame Spread Rating of Class 25 according to ASTM E-84. The lay-in units shall have a factory applied, white vinyl coating with a light reflectance of "A" - over 75%.

2-3 Acoustical ceiling system shall be similar to Item Number 838 as manufactured by the Armstrong Cork Company, Lancaster, Pennsylvania, or an approved equal.

PART 3: EXECUTION

3-1 The Contractor shall install acoustical material in strict accordance with the manufacturer's recommendation.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and applying sealer to all interior concrete floor slabs.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cast-In-Place Concrete - Section 03300.

PART 2: MATERIALS

Sealer shall be equal to Huntington Concrete Seal, or approved equal and shall be compatible with curing compound as specified in Section 03300.

PART 3: EXECUTION

Apply two coats of sealer at the rate of 500 sq. ft. per gallon as directed by manufacturer.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing all painting and finishing materials and the application of same. All surfaces except aluminum, stainless steel and factory prefinished items shall be finished under this Section whether or not specifically noted.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Silicone Dampproofing - Section 07150.

1-3 Work Included - The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work. The work also includes painting all exterior mechanical and electrical equipment including prefinished items such as roof top units, aluminum fans, etc.

The work includes field painting in finished rooms and exterior items of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed or finished metal surfaces of equipment installed under the mechanical and electrical work.

Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designatd, the Contracting Officer will select these from standard colors available for the materials systems specified.

1-4 Work Excluded - The following categories of work are not included as part of the field-applied finish work, or are included in other sections of these specifications.

(A) Shop Priming - Shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as architectural woodwork, wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

(B) Pre-Finished Items - Do not include painting when factory-finishing or installer finishing is specified for such items as metal toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, elevator entrance frames, doors and equipment.

(C) Concealed Surfaces - Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.

(D) Finished Non-Corrodible Metal Surfaces - Metal surfaces of anodized aluminum, stainless steel, chromium plate, bronze and similar finished materials will not require finish painting, except mechanical grilles forming part of the wall will be painted with the wall color.

(E) Operating Parts and Labels - Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1-5 Painting Conference - The Contractor shall schedule a conference of the general Contractor, painting subcontractor, technical representative of the paint supplier and the Engineer to discuss painting requirements before painting is started.

1-6 Samples and Colors - Engineer will furnish the Contractor a schedule indicating the selected colors. The Contractor shall then prepare in triplicate 8 1/2" x 11" samples of each color for approval by the Engineer. The Contractor shall also submit for approval a list of all materials proposed for use, including paint label analysis and application instructions for each material proposed for use. (See Section 01300.)

Before proceeding with painting, the Contractor may be required to finish one complete room. After approval, this sample room shall serve as a standard for texture, material and workmanship throughout the project.

1-7 Color Code References - Fuel Lines - American Petroleum Institut Bulletin 1542, Water Plants - Recommended Standards for Water Works of the Great Lakes - Upper Mississippi River Board of State Sanitary Engineers (10 State Standards).

PART 2: MATERIALS

2-1 Painting, staining, finishing and epoxy coating materials listed following are those of the Porter Paint Co., Kopper Co. or Mobil Chemical Co. This had been done to establish the standards of quality required for this project. Comparable products manufactured by Smith-Alsop, Glidden Pittsburgh shall be considered as equal products. (Other manufacturers may be submitted for consideration.)

The Contractor shall use one paint manufacturer throughout unless otherwise approved by the Contracting Officer.

If mechanical equipment is factory painted with the paint of a manufacturer different than the one selected for the finish coats, the surface shall be primed and painted with the paint of the manufacturer selected for the finish coats. Upon request from others, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required.

All materials used in the work except oils, thinners and driers, shall be of the brands and qualities specified and shall be delivered to the job in their original containers with labels intact and seals unbroken. Labels shall show name of manufacturer, type of paint, formulation, color of paint, and instructions for reducing.

All cleaners, thinners, driers and other additives and surface pretreatment materials delivered to the job shall only be those approved for use by the manufacturer of the paints.

No materials other than those specified or approved shall be delivered to the project site. All unapproved materials shall be removed from the project site and not used.

Color pigments shall be pure, non-fading, applicable types to suit the substrates and service indicated.

Lead content in the pigment is limited to contain not more than 0.5% lead, as lead metal based on the total non-volatile (dry-film) of the paint by weight. This limitation is extended to all interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows, and doors which are readily accessible to children under seven years of age.

2-2 Interior Paint Systems

Provide the following paint systems for the various substrates, as indicated.

The following are general purpose interior coating systems with materials identified by federal specification numbers.

(A) Concrete Masonry Units:

(1) For a lusterless (flat) emulsion over filled CMU surface.

P: 1st Coat - Surface filler (TT-P-1098).
2nd Coat - Interior latex emulsion (TT-P-29).
3rd Coat - Interior latex emulsion (TT-P-29).
Apply filler coat at a rate to ensure complete coverage with all pores filled.

(2) For a semi-gloss alkyd enamel finish.

E: 1st Coat - Surface filler (TT-F-1098).
2nd Coat - Enamel undercoater (TT-E-543).
3rd Coat - Semi-gloss alkyd enamel (TT-E-509).
Apply filler coat at a rate to ensure complete coverage with all pores filled.
Not less than 3.5 mils dry film thickness, excluding first coat.

2-3 Painting of Plants

A. General

1. Must meet the film thickness designated and/or the number of coats to be applied.

2. Must meet the same generic type of coating specified.

3. Request to use other manufacturers shall contain the full name of each product, descriptive literature, and directions for use; its generic type; its nonvolatile content by volume;

It is intended that all steel and iron, including piping and all iron coatings which are not embedded in concrete, together with all equipment, sheet metal ducts, and appurtenances shall be painte and if not specifically listed in the following schedule by name or exact identification, then such materials and equipment shall be painted according to the indicative listing for similar work.

On metal surfaces, the coverage per gallon per coat of paint is indicated in the following schedule by the bracketed number with the prefix of "C", and the dry mil thickness of each coat is indicated by the bracketed number with the prefix of "T". (For example, a paint with a covering of 250 sq. ft. per gallon per coat and a required dry mil thickness of 1.5 would be designated in the paint schedule as (C=250) (T=1.5).

B. Masonry

1. Interior - Non submerged:
   Poured or Precast Concrete:
   Koppers Glamorglaze 200 Epoxy (2 coats), or Mobil 84 Series (2 coats), or equal.

   Cement Block:
   Koppers Block Sealer (1 coat) and Koppers Glamorglaze (2 coats), or Mobil 79-W-8 (1 coat) and Mobil 84 Series (2 coats), or equal.

   Cinder Block:
   Koppers Surfacer (1 coat) and Glamorglaze 200 Epoxy (2 coats), or Mobil 79-W-8 (1 coat) and Mobil 84 Series (2 coats), or equal.

   Floors and Walks:
   Koppers Glamorglaze 200 Epoxy (2 coats - Thin first coat 10% with Koppers Thinner 10,000) or, Mobil 84 Series (2 coats) - thin first coat with one pint Mobil Thinner 7-T-35 per gallon of epoxy enamel, or equal.

2. Submerged (black color only) - includes basins, clarifiers, filter beds, filter troughs, flocculators, interior of pipes, mixing tanks, reservoirs, presedimentation tanks, wash water tanks:

   Koppers Torex 830 Undercoater (1 coat) and Koppers 800/Ramuc Utility Enamel (1 coat), or
   Mobil 27 Series (1 coat) and Mobil 28 Series (1 coat), or equal.

3. Submerged (color desired) - includes Aeration tanks, basins, chemical feeders, clarifiers, filter beds, filter troughs, flocculators, mixing tanks:

   Koppers Torex 830 undercoater (1 coat) and
   Koppers 800/Ramuc Utility Enamel (1 coat), or
   Mobil 27 Series (1 coat) and Mobil 28 Series (1 coat), or equal.

4. Exterior, above grade (color desired) - includes buildings and tanks:

   Koppers Silicone Penetrant (Primer - 1 coat) and Ramuc Exterior Masonry Paint (2 coats), or
   Mobil 46-V-6 (1 coat) and Mobil 27 Series (2 coats), or equal.

5. Exterior, above-grade (color not required but water repellancy needed as well as an efflorescent preventative) - includes buildings and tanks:

   Koppers Silicone Penetrant (1 coat), or
   Mobil 46-V-6 (1 coat), or equal.

6. Exterior Foundation walls (which require backfilling) - includes buildings and tanks:

   Koppers Bitumastic No. 300-M (2 coats - thin first coat at the rate of one part Koppers Thinner 2000 to two parts 300-M additional coat at normal unthinned rate), or Mobil 64-J-3 (2 coats, unthinned), or equal.

C. Wood

1. Interior, Non-submerged - Includes doors, frames, moldings, panels, sash:

   Koppers 625 Undercoater (1 coat) and Koppers Ponkote 300 Enamel (2 coats), or
   Mobil 17-W-4 (1 coat) and Mobil 84 Series (2 coats), or equal.

2. Exterior Trim - Includes doors, frames, sash:

   Koppers 625 Undercoater (1 coat) and Koppers Rustarmor 500 (2 coats), or
   Mobil 17-W-4 (1 coat) and Mobil 12 series (2 coats), or equal.

3. Wood Platform for Filters (walking surface)

   Porter - 1811 Polyurethane coating primer (T=2.0).
   Porter - 1811 polyurethane coating with abrasive particles for non-slip surface (T=2.0).

C. Metal

1. Nonsubmerged, normal conditions - includes hydrants, machinery, pipes, pumps, railings, steel doors, steel sash, valves:

   Shop Primer - Koppers Pug Primer (1 coat); Field Primer - Koppers Pug Primer (1 coat) (C=350) (T=1.5) and for

Interior Finish - Koppers Ponkote 300 Enamel (2 coats) (C=400) (T=1.4) or for Exterior Finish - Koppers Glamortex 501 Enamel (2 coats) (C=470) (T=1.4), or Shop Primer - Mobil 13-R-50 (1 coat) (C=340) (T=2.0), Field Primer - Mobil 13-R-50 (1 coat) (C=340) (T=2.0) and for Interior Finish - Mobil 84 Series (2 coats) (C=480) (T=1.5), or for Exterior Finish - Mobil 20 Series (2 coats) (C=500) (T=1.3), or equal.

2. Nonsubmerged, severe conditions of moisture and condensation, especially on below-grade surfaces which will be constantly wet - includes machinery, pipes, pumps:

   Shop Primer - Koppers Inertol Rustinhibitive Primer 621 (1 coat) (C=350) (T=1.5), Field Primer - Koppers Torex 820 Primer (1 coat) (C=365) (T=1.2) and for finish - Koppers Torex 810 Heavy (2 coats) (C=210) (T=2.0) and Koppers Torex 800 Enamel (1 coat) (C=370) (T=1.0), or Shop Primer - Mobil 13-R-50 (1 coat) (C=340) (T=2.0), Field Primer - Mobil 27 Series (1 coat) (C=135) (T=4.0), and for finish - Mobil 27 Series (2 coats) (C=135) (T=4.0), and Mobil 28 Series (1 coat) (C=340) (T=1.5), or equal.

3. Nonsubmerged, large areas (Color Desired) - includes bridges over clarifiers, exterior of stand pipes, and elevated water tanks, structural steel:

   Shop Primer - Koppers Pug Primer (1 coat) (C=350) (T=1.5), Field Primer - Koppers Pug Primer (1 coat) (C=350) (T=1.5), Finish - Koppers Rustarmor 500 Enamel (2 coats) (C=500) (T=1.4), or Rustarmor 500 Aluminum (2 coats) (C=500) (T=1.0), or Shop Primer - Mobil 13-R-50 (1 coat) (C=340) (T=2.0), Field Primer - Mobil 13-R-50 (1 coat) (C=340) (T=2.0), and Finish - Mobil 12 Series (2 coats) (C=500) (T=1.7), or equal.

4. Submerged (Black Color Only) - includes coagulation basins, flocculators, alum tanks, chemical feeders, gates, filter troughs, valve:

   Shop Primer - Koppers Inertol 49 (1 coat) (C=250) (T=1.2), Finish - Koppers Inertol 49 thick (2 coats) (C=150) (T=5.0), or Shop Primer - Mobil 35-J-12 (1 coat) (C=300) (T=2.1), Finish - Mobil 35-J-10 (2 coats) (C=100) (T=1.0), or equal.

5. Submerged (Color Desired) - includes aluminum tanks, wash water troughs:

   Shop Primer - Koppers Rustinhibitive Primer 621 (1 coat) (C=350) (T=1.5), Field Primer - Koppers Torex 820 Primer (1 coat) (C=365) (T=1.2), Finish - Koppers Torex 810 Heavy (2 coats) (C=210) (T=2.0) and Koppers Torex 800 Enamel (1 coat) (C=370) (T=1.0), or Shop Primer - Mobil 13-R-50 (1 coat) (C=340) (T=2.0), Field Primer - Mobil 27 Series (1 coat) (C=135) (T=4.0), and Finish - Mobil 27 Series (2 coats) (C=135) (T=4.0) and Mobil 28 Series (1 coat) (C=340) (T=1.5), or equal.

6. Submerged (semi-drying black grease coating desired) - includes chains, gates and other similar moving parts;

   Shop Primer - Koppers Rustinhibitive Primer 621 (1 coat) (C=300) (T=1.5), Finish: Inertol Grease Coating (1 coat) (C=40) (T=25.0), or Mobil 83 Series (2 coats) (C=75) (T=6.0) and one coat heavy grease, or equal.

2-4 Painting In-Plant Piping for Identification

General - This specification applies to all piping in treatment plants, well houses, and other process buildings except as designated elsewhere. These specifications conform to the American Standards Association color scheme for identifying piping, including pipe fittings, valves, and pipe coverings. Excluded are pipe supports and brackets.

(A) Federal Safety Red - This paint shall be used on piping used for fire protection such as sprinkler system piping, valves, and pumps.

(B) Federal Safety Yellow or Federal Safety Orange - These colors shall designate piping carrying dangerous materials such as flammables, poisonous gases, corrosive liquids, and liquids or gases at high temperature or pressure.

(C) Federal Safety Blue - This color shall identify piping carrying materials for preventing or reducing the hazards of dangerous materials, such as neutralizing agents for poisonous fumes. This does not include fire protection piping [See (A)].

(D) Federal Safety Green - This paint shall be applied to piping carrying safe materials, that is those materials which are non-flammable, non-poisonous, and are at low pressures and temperatures.

Application - For all metallic piping, solvent cleaning to remove all foreign substances will be used, followed by a suitable primer prior to application of the identifying colors. For other pipe materials and pipe coverings, follow manufacturers recommendations.

Color Identification - All paints in the color identifying shall conform to ANSI Specification 753.1.

In order to facilitate identification of piping in waste water plants and pumping stations, the following color scheme shall be utilized:

Water Lines

Raw	Medium Green
Settled or Clarified	Aqua
Finished or Potable	Light Blue

Chemical Lines

Coagulants	Dark Green
Polymers	Dark Green with yellow band
Carbon Slurry	Black
Chlorine (gas and solution)	Yellow
Fluoride	Light Blue with Red Band
Lime Slurry	Light Green
Fuel Tank	Dark Green (to match color of tank at warehouse, Mott Island)

Waste Lines

Backwash Waste	Light Brown
Sludge	Dark Brown
Sewer (Sanitary or other)	Dark Gray

Other Piping

High Pressure Air	Orange
Gas	Orange with Yellow Band
Sample Lines	Same color as process piping being sampled
Fuel Lines	See API Bulletin 1542

For inplant piping a 6" band of a contrasting color shall be painted on one pipe at approximately 30" intervals.

At prominent locations, the name of the contents shall be painted on the pipe, and arrows shall indicate the direction of flow.

2-5 Outside Paint Systems

This section covers three paint systems for painting the exterior or weatherexposed surfaces of steel tanks.

(A) Outside Paint System No. 1 - This is a three- or four-coat alkyd system over blast-cleaned or pickled surfaces. It is the most commonly used exterior paint system and provides very durable and economical protection. The three-coat system may be used for usual inland applications, but the four-coat system is recommended for marine or more severe exposures or for longer paint life.

PART 3: EXECUTION

3-1 WORKMANSHIP: All workmanship shall be of the very best with all materials evenly spread and smoothly followed on without runs or sagging.

All surfaces to which finish is to be applied shall be dry and clean. No finishing shall be done outside in extreme cold, frosty, foggy or damp weather. No finishing shall be done in dusty rooms.

No coats of finish shall be applied unless the preceeding coat is dry and hard.

Finishing shall be done only when the temperature is 50° or over and all surfaces shall be absolutely dry.

All surfaces before priming shall be thoroughly cleaned of all dirt, oil, grease, dust, scale and other foreign matter. This cleaning shall be wire brushed where necessary and sanded smooth.

The minimum degree of cleaning for any metal shall be hand or power tool cleaning or brush off blasting. All loose and detrimental matter shall be removed from the surface with this cleaning, but it is not intended that tight and adherent mill scale or existing paint be removed.

All surfaces shall be thoroughly cleaned of dirt, rust scale, loose rust, loose mill scale, welding flux and slag, oils and greases.

It is the intent that when any grade of cleaning is called for in this specification the cleaning shall be in accordance with the following specifications of the Steel Structures Painting Council of latest revision. These specifications shall also be used if any question shall arise on method of inspection.

(A) SSPC-SP-1 - SOLVENT CLEANING - Wherever excessive amounts of oils or greases are present, solvent cleaning shall be employed prior to any specified cleaning method.

(B) SSPC-SP-2 - HAND CLEANING - Hand cleaning is not intended to remove all tightly adherent mill scale, rust or paint, but all loose and detrimental foreign matter present shall be removed.

(C) SSPC-SP-3 - POWER TOOL CLEANING - Constitutes same degree of cleaning as described under hand cleaning above.

(D) SSPC-SP-5 - WHITE METAL BLAST CLEANING - All mill scale, rust, rust scale, paint or foreign matter is removed, leaving a slightly roughened, grey white, uniform metallic color.

(E) SSPC-SP-6 - COMMERCIAL BLAST CLEANING - This is intended to remove practically all mill scale, rust, paint, and other detrimental foreign matter but does not leave a surface of uniform color nor necessarily of uniform cleanliness.

(F) SSPC-SP-7 - BRUSH-OFF BLAST CLEANING - It is not intended that the surface shall be free of all mill scale, rust, and paint. The remaining mill scale, rust, and paint should be tightly adhered and the surfaces sufficiently abraded to provide good adhesion and bonding of paint.

(G) SSPC-SP-8 - PICKLING - Surface shall be completely free of all scale and foreign matter. Furthermore, the surface shall be free of unreacted or harmful acid, alkali or smut.

(H) SSPC-SP-9 - WEATHERING AND CLEANING - Weathering is a method of loosening or removing mill scale by natural oxidation. It is to be followed by an appropriate cleaning method to provide the desired surface.

(I) SSPC-SP-10 - NEAR-WHITE BLAST CLEANING - This removes all mill scale, rust, and foreign matter but leaves a grey white streaked appearance.

(J) SSPC-VIS-1 - and ASTM 2200 - PHOTOGRAPHIC REFERENCE - These visual standards show the degree of cleaning depending on the surface condition prior to blasting and may be used as a comparison for the actual surface.

3-2 Application

Provide necessary protection for completed work and adjoining surfaces. Provide temporary closures as required to prevent dust circulation from adjacent areas of the building where other work is in progress, or schedule the painting work to be done when other work in neighboring areas is not being performed. Keep new work protected at all times. Where it is necessary for the performance of painting to remove existing protection of work of others, such protection shall be fully replaced.

All work shall be performed by skilled personnel regularly engaged in this type of work. Surfaces shall be left free from drops, ridges, waves, laps and brush marks. Edges of paint adjoining other colors or materials shall be sharp, true and without overlapping.

Apply water-base paints only when the temperatures of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 90 degrees F.

Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces.

Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

Prime or seal coats of paint shall not be applied to wood in areas where cement, mortar or plaster is in the process of application or drying.

The rate of application of paint shall not exceed the average rate of coverage recommended by paint manufacturer for the type of surface involved, less 10 percent allowance for losses, unless manufacturer's paint specifications state that the recommended rate includes normal expected losses. The minimum dry film thickness per coat shall not be less than thickness set forth in the specifications. Deficiencies shall be corrected by additional coat(s) of paint.

Each coat shall be uniform in coverage and color. Each coat shall not perceptibly vary in color unless otherwise permitted by the Engineer. Number of coats shall be as specified or as required for the acceptance of the finish as approved by the Engineer. Each coat shall be carefully examined and faulty material, poor workmanship, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Comply with paint manufacturer's recommendations for drying time between coats.

Bottoms, sides and edges of doors shall receive same finish as faces of doors. If refitting of doors is done prior to final acceptance, the Contractor shall refinish all edges at no extra cost to the Owner.

Except where otherwise noted on drawings, incidental niches, recesses, passages, closets, etc., shall be finished to match similar or adjacent spaces whether such spaces are specifically mentioned or not. Access doors, panels, convectors, grilles and similar items shall be painted the same color as adjacent work, except where same are of non-ferrous metal or where otherwise indicated on drawings or directed by the Engineer.

Prime coated butts, or other prime-coated hardware shall be painted or grained to match adjacent work to which they are attached.

In the event that the finished surfaces do not conform with the approved samples, this Contractor shall do complete refinishing of such entire unit areas or sections as necessary in order to eliminate visible laps or other indications of repairs.

3-3 Clean-Up and Protection

(A) Clean-up - During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

(B) Protection - Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to the Architect.

Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3-4 Painting for Metal Buildings

This specification applies to all buildings, architectural frames, or other structure having metal structural supports or panels, unless otherwise specified.

3-5 Structural Painting

(A) All uncoated structural steel and light gage steel members shall be cleaned of all foreign matter and loose scale and given one coat of brown oxide primer. Paint to be applied by the use of airless hand guns or electrostatic automatic system. This paint can be used either as a protective primer coat or as a final coat because of its weathering ability.

(B) After erection of the structural frame work, all damaged areas and all unplated erection bolts will be touched up with the same primer.

3-6 Painted Steel Panels

(A) Prime Coat: Galvanized steel shall be prepaint treated with an amorphous complex oxide chemical conversion coating and then primed with an epoxy type primer for superior adhesion and superior resistance to corrosion.

(B) Finish Coat: After priming the exterior side shall be given a finish color coat with a thermosetting modified - silicone paint baked in excess of 600 degrees Fahrenheit to a controlled dry film thickness of .001 + .0001 inch.

Superior corrosion resistance of the paint system must be evident when tested in the salt fog test in accordance with ASTM, Method B-117-64. There shall be no blistering in excess of ASTM No. 6 on painted test panels, and there shall not be more than 20 percent of the area showing blistering when noted in accordance with ASTM Method D-71456.

After 100 hours exposure in the humidity test, the finish shall show only slight softening and blistering shall not exceed ASTM No. 8 and shall be limited to 10 percent of the area of the test panel.

3-7 Miscellaneous Metals

(A) Galvanized Metal - Exposed surfaces shall be given one (1) coat of galvanized metal passivator followed by two (2) finish coats of paint for applicable conditions as specified.

The following listed galvanized items are indicative of the materials and equipment included under this heading:

Vent and heating ducts
Ventilators
Galvanized pipe
Electric conduits
Galvanized tanks
Galvanized metal housing and guards
Galvanized parts of equipment

(B) Aluminum Materials - Such as handrailing, grating, ventilators, window sash, stop grooves, stop gates, troughs, weirs and like aluminum materials will not require painting unless otherwise specified in the Detailed Specifications.

(C) Bituminous Coated Pipes, Fittings and Valves - Which are coated with either coal tar or asphalt base material and which are exposed (and not subject to severe moisture or hydrogen sulfide gases per Sec. (d) of these Specifications) shall receive two (2) field coats of tar sealer before applying two finish coats of paint in color as specified herein for Sections (a) and (b). Note: The substitution of one (1) coat of non-bleeding aluminum paint may be substituted for the two coats of tar sealer provided there is no bleeding through which will adversely affect the two finish color coats. Also, heavy-duty enamel may be substituted for the two finish coats of paint over the aluminum seal coat. Any bleeding of the bituminous coating through the finished color coatings shall be satisfactorily repainted.

3-8 Scaffolding: The Contractor shall provide all scaffolding, staging, etc. required for the proper execution of this work.

3-9 Storing Paint: The Contractor shall assign a room or space in which to store all materials, which storage shall be confined to this room. All finishing materials must be brought to the job in unopened original containers.

END

PART 1: GENERAL

1-1 The work of this section consists of providing and applying the thermoset polyester resin with inert flake filler to the interior of new tanks and existing fuel storage tanks to be reused.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Tanks - Section 15175.

1-3 QUALITY ASSURANCE: References - Steel Structures Painting Council Specification SP-5.63, NACE Specification #1, Manufacturer's Instructions.

PART 2: MATERIALS

2-1 PRIMER: A primer shall be compatible with the thermoset polyester resin as recommended by the manufacturer. It shall have a minimum coat of dry film thickness of 2.0 mils. The primer shall be Ceilcote P-370 Primer or approved equal.

2-2 FINISH COATS: A finish coat shall be of thermoset polyester resin with inert flake filler at a dry film, thickness of 35-40 mils. The finish material shall be Ceilcote Flakeline 262 or approved equal.

2-3 PAINTING OUTSIDE OF TANK: Paint shall be dark green to match the color of existing tanks at warehouse, Mott Island.

PART 3: EXECUTION

3-1 Clean metal and sandblast to white metal finish per SSPC No. 5.

3-2 Apply primer according to the manufacturer's specification to a minimum dry film coating of 2 mils.

3-3 Apply the finish coat according to the manufacturer's specifications to a minimum dry film coating of 35 mils.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing wood gable-end louvers and metal soffit vents.

1-2 SUBMITTALS: Submit Shop Drawings fully describing wood gable-end louvers and metal soffit vents. (See Section 01300.)

PART 2: MATERIAL

2-1 LOUVERS: Gable-end louvers shall be equal to Style 1500, Pitched Louvers as manufactured by American Woodwork Specialty Co., Dayton, Ohio, or approved equal. Base width shall be 4'-0". Units shall be furnished for 6:12 roof pitch. Furnish and install complete with 16 mesh aluminum wire insect screen.

2-2 VENTS: Soffit vents shall be 2" w. aluminum strip vents x 8'-0" l. Furnish and install complete with 16 mesh aluminum wire insect screen. These shall be equal to Model H 798 as manufactured by Pease Company, Hamilton, Ohio , or approved equal.

PART 3: EXECUTION

Installation shall be in full compliance with manufacturer's directions.

END

SECTION 10670 STORAGE SHELVING

PART 1: GENERAL

1-1 DESCRIPTION: The work under this section consists of furnishing and installing metal storage shelving.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Painting and Other Finishes - Section 09901.

1-3 QUALITY ASSURANCE: OSHA.

PART 2: MATERIALS

2-1 Metal shelving shall consist of two shelf sections; each shelf section shall be 3 foot long x 18 inches deep x 84 inches high and shall consist of six shelves. Each shelf shall be capable of holding 250 pounds.

2-2 METAL SHELF FINISH: An epoxy finish shall be factory applied to the shelves to provide corrosion resistance to the finish shelving sections.

PART 3: EXECUTION

The shelving shall be assembled according to the manufacturer's written instructions and located where shown on the drawings.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing and installing all Toilet and Bath Accessories listed on the drawings.

1-2 SUBMITTALS: Submit Shop Drawings fully describing all Toilet and Bath Accessories required for the project showing size and location of all reinforcements and cut-outs to be provided by Metal Toilet Partition Manufacturer. (See Section 01300.)

1-3 RELATED WORK SPECIFIED ELSEWHERE: Metal Toilet Partitions - Section 10162.

PART 2: MATERIALS

Bobrick Washroom Equipment Model numbers have been used on the drawings to establish standard of quality. Comparable products as manufactured by Bradley Co. shall be considered as complying with this standard.

PART 3: EXECUTION

Toilet and Bath Accessories shall be installed in full compliance with manufacturer's directions. Railings shall further be installed and anchored so as to withstand a force of 300 lbs.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of supplying and installing the laboratory furnishings and test equipment.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Finish Carpentry - Section 06200; Painting and Other Finishes - Section 09901; Plumbing - Section 15400; Plumbing Fixtures and Trim - Section 15450; Electrical - Division 16.

1-3 QUALITY ASSURANCE: Manufacturer's written instructions, Michigan Clean Water Act No. 399, Standard Methods for the Examiniation of Water and Wastewater.

PART 2: MATERIALS

2-1 LABORATORY FURNISHINGS:

A. One (1) four drawer single cupboard, (18 1/2" wide), Curtin Matheson Scientific (CMS) #989-046 or equal.

B. One (1) 47" wide cabinet CMS #990-283 or equal.

C. One (1) corner unit assembly CMS #989-301 or equal.

D. One (1) 47" wide 4-drawer single cupboard unit CMS #989-194 or equal.

E. One (1) 35 1/2" assembly 2-drawer double cupboard CMS #989-145 or equal.

F. One (1) sink assembly 49" wide, with Epoxy-resin top, #CMS 990-283 or equal. This unit consists of the following:

G. Sink base unit, 47" wide CMS #989-095 or equal.

H. Sink supports, 47" CMS #989-533 or equal.

I. Epoxy-resin sink 24" x 16" x 8" deep I.D. CMS #979-716 or equal.

J. Plastic sink strainer 1 1/2" CMS #987-560 or equal.

K. Plastic trap 1 1/2" CMS #987-586 or equal.

L. Mixing faucet, deck mount, 3/8" I.P.S., Style B, epoxy-resin sink top, 30" deep with 4" curb CMS #978-759 or equal.

The above units shall be supplied with all incidental and finishin materials needed for proper installation, as well as a 30" wide epoxy resin bench top with 4" raised area around the wall and a 1/4" lip on the edge of the bench top of sufficient length to cover the cabinets, approximately 15 1/2 feet.

M. One (1) adjustable laboratory chair CMS #991-380 or equal.

N. One (1) ventilation fan.

O. One (1) Lyon, Special Purpose Locker, double door locker, 24" wide, 21" deep, 72" high, or equal.

2-2 LABORATORY EQUIPMENT AND SUPPLIES:

A. Two (2) laboratory notebooks.

B. Three (3) sponges.

C. Two (2) thermometers (-1° to 51°C) CMS #228-908 or equal.

D. Two (2) stainless steel tongs CMS #232-330 or equal.

E. One (1) case paper tissue wipes CMS #325-589 or equal.

F. One (1) case paper towels CMS #325-605 sturdi-wipes or equal.

G. Four (4) glass liter storage bottles CMS #033-993 or equal.

H. Four (4) 500 ml storage bottles CMS #033-902 or equal.

I. One (1) glass alcohol burner CMS #151-415 or equal.

J. One (1) package wicks for alcohol burner (36 per pkg.) CMS #151-423 or equal.

K. One (1) package sterile membrane filters and absorbent pads (100 per pkg.) Millipore #HAWG 047SO or equal.

L. One (1) box of 500 sterile plastic bags CMS #205-088 whirl-pak or equal.

M. One (1) 8-pint bottle of 95% denatured alcohol J. T. Baker #3-9229 or equal.

N. One (1) bar refrigerator.

O. One (1) pound potassium dihydrogen phosphate J. T. Baker #1-3246 or equal.

P. Four (4) rolls aluminum foil CMS #463-562 or equal.

Q. Four (4) 500 ml aspirator bottles CMS #038-620 or equal.

R. Twelve (12) narrow mouth pyrex bottles - using #6 rubber stopper CMS #034-066 or equal.

S. One (1) pound (approx. 17) #6 rubber stoppers CMS #202-101 or equal.

T. Two (2) beaker brushes CMS #049-791 or equal.

U. Two (2) graduate brushes CMS #051-391 or equal.

V. Forty-eight (48) vials Millipore MF-Endo broth #M0000002E or equal.

W. One (1) variable speed six unit stirrer CMS #214-841 or equal

X. Twelve (12) graduated liter beakers CMS #030-023 or equal.

Y. Twelve (12) 150 ml graduated beakers CMS #029-975 or equal.

Z. One (1) pH meter Hach #16400-00 or equal.

AA. One (1) box glassine paper CMS #185-918 or equal.

BB. Six (6) grease pencils CMS #186-213 or equal.

CC. Two (2) pair safety glasses CMS #170-985 or equal.

DD. One (1) water still CMS #368-779 Corning Mega-Pure or equal.

EE. One (1) metric trip balance CMS #025-460 or equal.

FF. One (1) copy of "Standard Methods for the Examination of Water and Wastewater", latest edition CMS #238-857.

GG. Three (3) boxes Alconox cleaning compound CMS #462-416 or equal.

HH. Two (2) stainless steel 9" spatulas CMS #208-678 or equal.

II. One (1) pound sodium hydroxide J. T. Baker #1-3722 or equal.

JJ. One (1) pound magnesium sulfate heptahydrate J. T. Baker #1-2500 or equal.

KK. Two (2) filtering units Millipore #XX1004700 or equal.

LL. Three (3) 1 liter side arm flasks CMS #102-715 or equal.

MM. One (1) vacuum pressure pump CMS #234-187 or equal.

NN. Twenty (20) ft. 5/16" vacuum tubing CMS #248-476 or equal.

OO. Fifty (50) ft. 1/4" rubber tubing CMS #244-525 or equal.

PP. Twelve (12) graduated mil dilution.

QQ. One (1) air incubator 35°C CMS #147-124 or equal.

RR. Two (2) safety bulb pipet fillers CMS #269-654 or equal.

SS. Eighteen (18) pyrex 10 ml pipets CMS #k88-888 or equal.

TT. Eighteen (18) pyrex 1 ml pipets CMS #188-854 or equal.

UU. One (1) 24" support stand CMS #220-152 or equal.

VV. Six (6) buret clamps CMS #058-982 or equal.

WW. Twelve (12) 100 ml graduated cylinders CMS #074-096 or equal.

XX. One (1) sterilizer CMS #209-536 or equal.

YY. Two (2) MF filter forceps Millipore #XX6200006 or equal.

ZZ. Two hundred (200) plastic culture dishes Millipore #PD1004700 or equal.

AAA. One (1) rubberized lab apron CMS #021-733 or equal.

BBB. One (1) alkalinity kit Hach AL-AP #1433-00 or equal.

CCC. One (1) chlorine test kit Hach CN-66 #2231-01 or equal.

DDD. One (1) total hardness kit Hach HA-71A #1452-01 or equal.

EEE. One (1) square plastic bucket.

FFF. One (1) fire blanket and box CMS #121-079 or equal.

GGG. Two (2) eye wash stations CMS #341-222 or equal.

HHH. One (1) industrial size first aid kit CMS #121-152 or equal.

III. One (1) spill bucket CMS #256-842 or equal.

JJJ. One (1) single head drench shower Haws Model 8169, installed in laboratory ceiling with chain through ceiling and pull handle below ceiling.

KKK. One (1) tri-class fire extinguisher CMS #121-095 or equal.

2-3 PROCESS TEST EQUIPMENT:

A. One (1) Turbidimeter Hach 1720A with 12 foot interconnecting cord between sensor and master indicator, or approved equal.

B. One (1) turbidimeter floor stand, Hach #15954 or equal.

C. One (1) Rustrack Hach #78561-41 with alarm or equal.

D. One (1) circuit card Hach #15640 or equal.

E. Twelve (12) packages chart paper Hach #554 or equal.

PART 3: EXECUTION

3-1 All furnishing shall be installed as shown on the drawings and according to the manufacturer's written instructions.

3-2 Laboratory equipment shall be delivered and placed where accessible. Any equipment requiring electrical or plumbing connections such installation shall be completed.

3-3 The turbidimeter shall be installed on the effluent of the filters with a remote readout in the laboratory. The installation shall be as shown on the drawings and according to the manufacturer's written instructions.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section contains general requirements for mechanical construction work.

1-2 DESIGN AND FABRICATION:

A. All of the equipment for the projects shall be designed for continuous service unless specified otherwise and related device items shall be amply proportioned for all stresses that may occur during continuous operation and for any additional stresses that may occur during fabrication, erection and intermittent operation.

B. Particular attention will be given to the ruggedness of the structural and mechanical features of the designs to insure long life of the equipment, low maintenance costs, and devices and features to permit effective methods of repair, ease in servicing the equipment. Workmanship and materials shall be of the highest grade in all respects.

C. Attention of manufacturers of major equipment is particularly called to the importance which the Contracting Officer will pay in reviewing the shop details submitted for approval before fabrication. All lightweight sections of equipment and/or metal parts subject to appreciable wear or loss in efficiency will be disapproved where, in the judgment and experience of the Contracting Officer, heavy and/or better grades or types of metal could have been selected are generally specified.

D. All major equipment shall have appropriate lugs, hooks, or other lifting devices to facilitate their installation and removal.

E. All high speed rotating parts shall be both statically and dynamically balanced for a minimum of vibration and the noise level shall not exceed the OSHA Standards. If necessary special soundproof enclosures shall be provided and furnished as part of the equipment and be included in the item cost.

F. For all welding work, the manufacturer's shop welding, and the Contractor's field welding procedures, welders, and welding operators shall be qualified and certified in accordance with the requirements of AWS D1.0 "Welding in Building Construction" of the American Welding Society.

G. The shop drawings shall clearly show complete information regarding location, type, size, and length of all welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society. Special conditions shall be fully explained by notes or details.

H. All motors supplied with the equipment shall be of the high efficiency design. The motors shall have an efficiency rating of not less than 81% for wire to output shaft.

I. All exposed moving parts with which it is possible for persons to come in contact with, shall be properly shielded, or enclosed, as required by OSHA for the safety of personnel.

1-3 SUBMITTALS: Submit Air Balance Test Results.

PART 2: MATERIALS

2-1 HARDWARE AND SPECIAL TOOLS:

A. All hardware, except that pertaining to electrical connections for conductance, involved in the operation, maintenance, or repair of equipment such as nuts, bolts and washers, shall be a corrosion resistant material such as stainless steel or bronze.

B. Tapped holes and studs shall not be used wherever there is an option to use bolts with nuts.

C. Hardware or parts requiring special tools, such as metric wrenches, for the installation or repair of the equipment shall not be used unless approved by the Contracting Officer, and those approved shall be furnished as part of the equipment in duplicate with instructions for their use. Any equipment fitted with metric fasting shall be conspicuously marked.

2-2 SPARE PARTS AND SPECIAL MATERIALS:

A. All equipment shall be of a type being so designed and having a quality of materials and workmanship to enable operation in continuous service for a period of at least five (5) years and for intermittent service a period of fifteen (15) years, without requiring major repair work, except for those parts in contact with process materials having a deteriorating effect such as grit in pumps. The manufacturer shall furnish as part of the equipment a replacement for each part not having a normal use expectancy as stated above.

B. A supply of special materials required for the servicing and operation of the equipment such as lubricants, ink and charts for recorders, etc., during the period of the guarantee shall be included by the manufacturer as part of the equipment furnished.

C. The bidder shall include the cost of such spare parts and special materials in the appropriate bid item in the proposal.

D. The Contractor shall furnish as part of the shop drawings a list by the manufacturer of all the spare parts and special materials to be furnished.

2-3 DATA PLATES: Stainless steel data plates shall be suitably attached in a prominent place on all equipment items. They shall clearly show the manufacturer's name, address, make, type, model and serial numbers, size, rating, all electrical data, and any other pertinent data.

2-4 PAINTING: Paint exposed surfaces of all equipment with approved paint before shipment. Leave all machined surfaces bright and finished. After erection, remove all scratches and paint entire surface with a paint system, conforming to the applicable requirements of Division 9 of these Specifications.

PART 3: EXECUTION

3-1 GENERAL: All work shall be performed in accordance with standard practice.

3-2 WORK INCLUDED:

A. Water service
B. Soil piping system
C. Water heating
D. Hot, cold and tempered water piping
E. Plumbing fixtures and trim
F. Pipe insulation
G. Exhaust system including fan and ductwork.

3-3 WORK NOT INCLUDED:

A. Electrical
B. Painting

3-4 DISINFECTION OF WATER LINES:

A. After water piping systems are completed, the cold water system shall be flushed with chloride of lime solution in accordance with the requirements of the Michigan State Board of Health.

3-5 TESTING OF WATER, SEWER AND FUEL LINES:

A. Water line shall be tested at 100 p.s.i. and found tight at that pressure.

B. Sewer system shall be tested with air. After all fixtures are set and traps filled with water, the entire drainage system shall be submitted to a final air pressure test in the presence of the Contracting Officer.

3-6 TESTING, ADJUSTING AND BALANCING OF AIR SYSTEM:

A. Check air flow at all exhaust grilles with anemometer and adjust dampers to deliver noted quantities.

B. Check current consumption of fan motor.

C. Submit duplicate copies of the final readings to the Contracting Officer. (See Section 01300).

3-7 MATERIALS MANUFACTURERS:

A. Wall Hydrants - approved equal to Josam
B. Domestic Water Heater - approved equal to A. O. Smith Co.
C. Plumbing Fixtures - approved equal to American Standard
D. Flush Valves - approved equal to Josam
E. Mop Service Basin - approved equal to Powers-Fiat
F. Exhaust Fan - approved equal to Penn Ventilator Co.
G. Grilles - approved equal to Airguide
H. Louvers - approved equal to Penn Ventilator Co.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of furnishing and installing all piping and pipe fittings, including connections to existing pipe as shown on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavating and Backfill - Section 02220.

1-3 QUALITY ASSURANCE: Reference, American Society for Testing and Materials (ASTM), National Fire Protection Association Codes, American Water Works Association (AWWA), National Sanitation Foundation (NSF).

1-4 MATERIAL HANDLING:

A. Responsibility for Material Furnished by the Contractor: The Contractor shall be responsible for all material furnished by him and shall replace at his own expense, all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

B. Responsibility for Material Furnished by Government: The Contractor's responsibility for material furnished by the Government shall begin at the point of its delivery to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of the award of the contract. The Contractor shall examine all material furnished by the Government at the time and place of delivery to him and shall reject all defective material. Any material furnished by the Government and installed by the Contractor without discovery of such defects will be replaced with sound material by the Government. The Contractor, however, shall at no additional cost to the Government, furnish all supplies, labor and facilities necessary to remove said defective material and install the sound material.

C. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

D. Replacement of Damaged Material: Any material furnished by the Government that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at no cost to the Government.

E. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor.

F. Care of Pipe Coating and Lining: Pipe shall be so handled and stored that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at no cost to the Government in a manner satisfactory to the Contracting Officer.

1-5 INSPECTION:

A. Shop Inspection: All materials furnished by the Contractor are subject, at the discretion of the Contracting Officer, to inspection and approval at the manufacturer's plant.

B. Field Inspection: All pipe and accessories shall be laid, joined and tested under pressure for defects and leakage in the manner specified and in the presence of, and as approved by, the Contracting Officer.

All pipe fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position, as specified in the purchaser's addendum to this standard. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Contracting Officer, who will prescribe corrective repairs or rejection.

C. Disposition of Defective Material: All material found during the progress of the work to have cracks, flaws or other defects shall be rejected by the Contracting Officer. All defective materials furnished by the Contractor shall be promptly removed by him from the site. Any material furnished by the Government and found defective shall be set aside and removed from the site of the work as directed by the Contracting Officer.

PART 2: MATERIALS

2-1 PIPE MATERIALS:

A. Galvanized Steel Pipe: All pipe in this classification is intended for ordinary uses in water and fuel lines, and shall conform in all respects to ASTM Standards, Designation A-120 latest revision thereof.

B. Copper Pipe: all copper pipe shall conform to the latest revision of the ASTM "Standard Specification for Seamless Copper Water Tube, Designation B-88". Tube shall be Type K, soft temper for underground service. Type L hard copper tube shall be used for interior applications involving general plumbing and heating.

C. PVC Pipe: All PVC pressure pipe, fittings and compound shall conform to AWWA C-900. Joints shall be of bell-tite type or solvent weld as specified. All joints and elbow, shall be of equivalent strength as specified for the pipe with which they are used.

Gravity PVC sewer pipe shall be bell-tite type ASTM D-3034 PSM (SDR-35) and be tested in accordance to ASTM 2412. All pressure pipe 1 1/2" and smaller shall be solvent weld joints and conform to ASTM D-2241 SDR 13.5 or CS-207 sch 80 fittings shall conform to CS-207 for sch 40 when unthreaded and sch 80 when threaded. All PVC pipe shall bear the National Sanitation Foundation (NSF) seal of approval.

D. Fiberglass Pipe: All fiberglass pipe, fittings and accessories shall conform to ASTM D-2310, D-2996 and RTRP-11AD-5111. All joints, elbows and fittings shall be of equivalent strength as specified for the pipe with which they are used. The resin used shall be recommended for use with aviation fuel.

E. Polyethylene Pipe: All pipe in this classification shall be made from virgin materials polyethylene resin Type III, Grade 3, Class C with a density of 0.955 and meet the standards of ASTM D-2239, ASTM C-1248 and ASTM D-1505. The pipe shall contain no less than 2% carbon black, well dispersed for protection from ultraviolet light. The pipe shall have a working pressure rating of 160 pounds per square inch. The sizes shall conform to the nominal sizes shown on the drawings and conform to the inside and outside diameters of Ryerson Mono-Line pipe or approved equal.

F. Reinforced Flexible Clear Vinyl Tubing (polyvinyl chloride): All tubing of this class shall be clear flexible at temperatures to 0°F and be of food and beverage grade. The tubing shall be reinforced with nylon brand within the walls and have a working pressure of not less than 165 psi and a bursting pressure of 825 psi with a maximum operating temperature of 150° F.

G. Cast, Ductile Iron Pipe: All cast and ductile iron pipe for underground installations shall conform to AWS A21.6 (AWWA C 106), A 21.8 (AWWA C 108) or A 21.5 (AWWA C 151) and shall have mechanical joints with retainer glands conforming to ANS A 21.11 (AWWA C 111) unless shown otherwise on the drawings.

Interior lining and cement mortar shall conform to ANS A 21.4 (AWWA C 104).

2-2 FITTINGS:

A. Fittings for Copper Pipe: Fittings for copper piping shall be wrought pure copper or extra heavy red brass, carefully manufactured of the proper type and size to make up the necessary connections. All fittings which are used with Type K copper tube shall be of the extra heavy red brass flared type and all fittings used with Type L copper tube shall be of the wrought pure copper solder type.

B. Fittings for Screwed Ferrous Pipe: Fittings for screwed pipe shall be of malleable iron. In general, all fittings shall be screwed fittings, but flanged fittings shall be furnished, where shown on the drawings. All threads shall be cut in such a manner that they are clean, tapered and smooth. Flanges shall be faced and drilled to the American Standard or to special drilling where shown on the drawings or required. Where tap or stud bolts are used, flanges shall also be tapped. Flanged union shall be used on all pipe larger than 2 inches in diameter. Railroad unions with brass to iron seat shall be used on all piping 2 inches in diameter and smaller. Union elbows or tees with brass to iron seats on the union end shall be furnished where shown on the drawings. Fittings used with galvanized pipe shall be galvanized.

C. Fittings for polyethylene pipe shall be factory made and shall be jointed to the piping by a fusion process recommended by the manufacturer. Where polyethylene pipe is to be jointed to ferrous pipe or fittings a polyethylene stub end backed by a nylon coated ferrous flange shall be used to make the connections. All ferrous flanges shall conform to ASA 125 drilling for bolt circles and bolt hole sizes. Bolts and nuts for fastening flanges shall be of corrosion resistant alloys or plated to prevent corrosion. Where shown on the drawings, wher the parts are to be disassembled annually stainless steel nuts and bolts are to be used. The bolts and nuts shall be 18-8 stainless steel coarse thread.

D. Fittings for reinforced flexible clear vinyl tubing shall be polypropylene or nylon with a working pressure of not less than 125 psi. The fitting shall not restrict the flow.

E. Fitting for Cast or Ductile Iron Pipe: The type of fittings shall be as indicated on the plans and shall conform to ANSI - A21.10 or ANSI - A21.11.

PART 3: EXECUTION

3-1 GENERAL: Install pipe, fittings and appurtenances of the types and sizes shown on the drawings and in the locations, lines and grades shown thereon.

All pressure pipe shall be restrained to withstand thrust, and pressure tested at 1 1/2 times the maximum operating pressure, as per the manufacturer's recommendations for pressure testing and leak testing. All pressure piping shall have a minimum pressure rating of 150 psi. All linings, joint compounds, etc., shall be inert to the fluid to be carried.

3-2 ERECTION:

A. The piping shall be made up with sufficient number of unions to permit ready breaking of lines at all points for inspection or maintenance. Unions shall be located at such points as shown on the Contract Drawings. All screwed piping shall be screwed together with an application of non-hardening joint compound. This application shall be carefully watched with joint compound only on the male threads and all joint compound and dirt thoroughly wiped off the inside of every joint. Flanged joints shall be made up with rubber gaskets with cloth insertion of satisfactory thickness and type.

All pipe must have burrs removed from the ends and no bending will be allowed where fittings can be used. All piping shall be erected to accurate lines and grades and shall be supported as shown on the drawings. All piping shall be laid to drain.

B. All PVC or plastic pipe shall be installed with drain corks at the low points and air-vacuum valves at high points, as per the manufacturer's recommendations.

C. Polyethylene pipe installation shall conform to the manufacturer's written instructions with special precautions at flanges as follows: polyethylene pipe connected to heavy fittings, manholes and rigid structures shall be supported in a manner that no subsequent relative movement between the polyethylene pipe at the flanged joint and the rigid structures is possible.

D. The tubing shall be installed where shown on the drawings with fitting and according to the manufacturer's written instructions.

3-3 PIPE SLEEVES: Where pipes pass through a wall or floor, pipe sleeves shall be provided where indicated on the drawings or directed by the Contracting Officer. Sleeves not a part of the pipe line itself shall be caulked with lead and oakum for metal pipes and expanding grout for plastic or fiberglass pipe where water-tightness is essential. Where water-tightness is essential, sleeves shall be provided with a waterstop in the wall.

3-4 PIPE SUPPORTS FOR INTERIOR PIPING: Piping supported from ceilings or beams shall be supported by means of suitable approved adjustable tie rods and adjustable swivel rings. Wall supports of standard design suitable for supporting the number, weight, and thrust of pipe shall be furnished and installed where required. Where piping is supported from the floor, saddle stands or their equivalent shall be used. The supports shall allow for a uniform grade in the pipe and spacing shall be such as to prevent sagging deflection between supports.

3-5 PAINTING: All exposed piping, covering, supports, and hangers shall be painted as specified under Painting - Division 9.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing traps, shock absorbers, flashing, ball joints and hangers and supports to be incorporated in the plumbing and water system.

1-2 RELATED WORK SPECIFIED ELSEWHERE: None

1-3 QUALITY ASSURANCE: 1 AMPO, manufacturer's printed recommendations, and BOCA Code.

1-4 SUBMITTALS: Submit shock absorber and swivel joint shop drawings. (See Section 01300).

PART 2: MATERIALS

2-1 TRAPS: Cast iron deep seal with top unlet for inside caulk outlet and caulked flush floor cleanout.

2-2 SHOCK ABSORBERS: Stainless steel shell, hydro-pneumatic cushion, elastomer bellows, stainless steel adapter and female threaded plub.

2-3 FLASHINGS: Four pound prefabricated type.

2-4 HANGERS: Wrought steel clevis type with threaded rod.

2-5 SWIVEL JOINT: Cast swivel base elbow shall be 4 inch ductile iron flanged with stainless steel ball bearings and triple O-rings for submerged service. The unit shall be permanently lubricated. A two inch pipe drilled and welded into the base fitting shall be provided as shown on the drawings. The cast swivel base elbow shall be equal to OPW, Style 3835F as manufactured by Dover Corporation or approved equal.

PART 3: EXECUTION

3-1 TRAPS: To be installed connected to each floor drain.

3-2 SHOCK ABSORBERS: To be installed at end of each plumbing hot and cold water header in each utility space and in hot and cold water connection for clothes washers.

3-3 FLASHINGS: To be installed on each plumbing.

3-4 HANGERS: To be installed with one half inch rod threaded three inches on each end. Maximum spacing of supports shall be seven feet for one inch IPS, nine feet for one and one half inch IPS and ten feet for two inch IPS. Hangers to fit over insulation with galvanized metal protective shields between hanger and insulation.

3-5 CAST SWIVEL BASE ELBOW: To be installed according to the manufacturer's written instructions.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of providing all manual valves, cocks, and faucets, as shown on the drawings and as specified and providing the operators required as shown on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Pipe and Pipe Fittings - Section 15060; Basic Materials and Methods - Section 16100; Controls, Instrumentation and Alarms - Section 16900.

1-3 QUALITY ASSURANCE: References, American Society for Testing and Materials (ASTM B-62), American Water Works Association (AWWA) and Manufacturer's printed recommendations.

1-4 SUBMITTALS: Submit valves, cocks and faucets shop drawings.

PART 2: MATERIALS

2-1 GATE VALVES:

A. 3 Inch or Larger: All gate valves on pipe lines 3 inch or larger, unless otherwise indicated on drawings; made-up gate, double-disc type, iron body, bronze mounted, with non-rising stem. All working parts and bearing surfaces: bronze or bronze mounted. Valves shall open by turning to left. Equip valves for underground installation with an operating nut and either bell or mechanical joint ends. Equip valves for above ground installation with proper size handwheel (with arrow indicating direction of rotation to open). Furnish same with Class 125 flanged ends.

Gate valves (except as noted below) shall conform to AWWA Specification C-500, latest revisions. Valves installed above ground, and in pipe lines with less than fifty (50) psi; shall conform in essence to above mentioned specifications, but may be of lighter construction than specified herein. All valves of approved design, suitable for service and pressures encountered.

B. 2-1/2 Inch and Smaller: All valves, on pipe lines, two and one-half inches or smaller size; brass or iron body-brass trimmed gate valves, unless otherwise indicated on drawings. All valves - suitable for 125 psi working water pressure. FS-WW-X-54c Class A, Type, sizes as shown.

C. Gate Valves Inside Fuel Storage Containment Areas: Gate valves located within the containment areas at the fuel storage sites shall be constructed of steel or stainless steel and shall have elastomers and packing rated to 450°F. These valves shall have non-shock working pressure ratings of 150 psi.

2-2 BUTTERFLY VALVES:

A. General: Butterfly valves shall only be used where there is no material in the flow stream that could collect on the disc, and shall not be used for continuous throttling or regulating high pressure flows unless approved by the manufacturer.

B. The valve and operator shall be constructed and/or tested to comply with AWWA Standard C-504, latest revision except for the following modifications:

1. Rubber seats on valve bodies shall be readily replaceable in the field; and those valves which enable removal of equipment, having flanges or lugged bodies, shall be tested without downstream flanges.

2. For all valves, other than those under 24 inches which are located to enable ready removal from the piping and around which plant flow can be bypassed, the external shaft seal shall be the adjustable packing type which can be replaced without disturbing the valve and operator assembly.

3. Those types of valves which do not meet AWWA dimensional requirements, must be certified by a recognized independent laboratory that such valves meet AWWA test and stress requirements and furnish satisfactory evidence of compliance.

C. Manual valves shall have work gear type operators having handwheels and be right hand valves (rotation clockwise to close) unless specified otherwise. All other types of operators shall have means for manual operation if the powered operator fails.

D. For all valves in horizontal lines which could possibly contain abrasive material such as sand, the bottom half of the disc shall close by rotating upstream about a horizontal shaft to enable self-flushing of grit.

E. All valves of the same size and service shall be of the same make and type having interchangeable parts.

F. The bypass valves for backwashing the intake screen shall be flangeless resilient seat type with two-piece iron body with the split case held together with stainless steel cap screws. The one piece disc and stem shall be hand polished and the valves factory tested to be bubble type at full rating. The valves shall be Keystone, Figure 99 or approved equal.

G. Float Controlled Butterfly Valve: A float controlled butterfly valve shall be supplied for the control of the sand filter effluent. The valve shall meet AWWA standards. Valve shall be supplied as part of the filter system.

2-3 BALL VALVES:

A. General: Ball valves shall be of the screwed end type constructed of the following materials: composition bronze, ASTM B-62 for the valve body and body adaptor; hardware bronze, B-140 AL 314 for valve ball; Cu-zn-si Alloy, B-371 AL 697 for valve stem; and commercial steel for valve handle. In addition, all ball valves shall be equipped with fire-seal seats reinforced with TFE, rated at a maximum temperature of 450°F for operating pressures of 100 psig or less; and all ball valves shall have a maximum pressure rating of 900 psig for operating temperatures of 0°F to 100°F. The fire seal seats shall be such that if excessive heat should destroy the plastic seat material, the metal-to-metal contact between the ball and secondary seating surface will stop the flow of fluid. The mating surfaces between ball and seats shall be smooth, clean and non-abrading with no lubricant required. The valves shall have quarter-turn operation, double-sealed and back-seated stem, plus pre-stressed, nonflexing seats for positive, leaktight closure. The valve shall be adaptable to the use of electric actuators. The valves shall be Hills-McCanna, McCannaflo Series B-402 ball valve or approved equal.

B. Valve Sizing Constants: All ball valves shall meet or exceed the minimum valve sizing constants (Cv)* given below:

Valve Size Inches	Minimum Cv
1"	25
1-1/2"	35
2"	100
3"	250

*Cv is the flow in gallons per minute of water for a 1 psig pressure drop across the valve.

2-4 SAMPLING COCKS: Sampling cocks shall be smooth nosed and either chrome plated or brass finish. They shall be similar and equal to American Pattern No. 900.

2-5 STOP COCKS:

A. Stop cocks shall have a polished brass dial face and handle, rough brass body ground key cock, a pressure rating of 150 psig, and a temperature rating of 350°F. The valve shall provide a leaktight closure.

B. Stop cock for comfort station shall have inverted key tee handle, bronze body with adapters for plastic pipe and with operating rod and clamp.

2-6 GLOBE VALVES: FS-WW-X-51d Class A, Type 1. Sizes as shown.

2-7 CHECK VALVES:

A. 3 Inch and Larger: Swing type check valves, three inches and larger, iron body, bronze mounted; disc shall swing entirely free of waterway when in open position; shall be type suitable for horizontal or vertical installation, as required. All valves, non-slam design; shall be furnished with extended hinge pin, outside lever and adjustable weight. Valve body - high strength cast iron, with Buna-N seat. Machine bronze rings to assure tight closing. Gate: perfectly balanced and hung from stainless steel hinge pin, with solid bronze hinges. Gate and all working parts: easily removable through top of valve after cover is removed. All valves: suitable for working water pressure of one hundred fifty psi. Furnish same with Class 125 flanged ends or as otherwise indicated on drawings.

B. Swing check valves, two and one-half inches and smaller: FS WW-X-51d, Class A, Type 1X, 125 psig, SWP.

C. Tilting Disc and Wafer Types, Non-Slam: For those locations where the flow contains no stringy material or solids that would necessitate access to the clapper of disc for cleaning, the check valve may be the wafer type to fit between standard 125 lb. flanges having a single piece swing type clapper or disc, spring loaded for positive closing. Where the average velocity is four feet per second or greater, or where fittings interfere with clapper a more streamlined eccentric disc type shall be used such as the Chexter, by Daniel Industries, Inc., Box 19097, Houston, Texas 77024, APCO Series 800 Slanting Disc by Valve and Primer Corporation, Schaumburg, Illinois, 60172 or approved equal.

For velocities less than 4 feet per second the safer check valve may be the swing clapper type such as the K-F valve by the Prince Valve, Inc., Box 1003, Norman, Oklahoma, 73069 or approved equal.

The body shall be of either ductile iron or steel the clapper or disc shall be of a non-corrodible material such as al-bronze, stainless steel, or equal. The seat seal shall be field replaceable buna-"N"-rubber, the spring hinge stem and all hardware including lifting eye bolt shall be stainless steel or other approved material.

D. Plastic Ball Check Valves: All valves of this type shall be thermoplastic ball check valve of PVC Type I, Grade I. Valve shall insure a positive seal to prevent reverse flow even at a back pressure of 7 feet of water. The design shall not allow for ball sticking or chattering. The valve shall have complete union design. The valve shall be Chemtrol Series BC or approved equal.

2-8 SELF CONTAINED CONTROL VALVES:

A. Dry Disconnect Couplings: Dry disconnect couplings shall contain open/close lever plus its own valve assembly. The valve consists of a spring-loaded poppet disc which firmly closes the coupler until opened by the open/close actuating lever. The coupling shall be adaptable for hose and pipe with connections and disconnections both accomplished simply by closing and opening two cam-arms which lock into a machined groove around the circumference of the mating adaptor. There are no locating lugs or threads. When the actuating lever is placed into the open position, the coupler poppet moves towards the adaptor poppet disc until these two mating discs make contact. Complete turning of the lever to the full open position causes the coupler poppet to extend beyond the end of the coupler, depressing the adaptor body, which creates clearance for liquid flow around both discs. When the lever is returned to the close position and disconnect is made, the disc faces of these poppets shall remain in contact until the coupler and adaptor are separated so as to minimize product loss during disconnect. Should accidental disconnection of coupler and adaptor occur while the lever is in the open position, both coupler and adaptor shall automatically shut off so as to prevent spillage.

The adaptor and coupling shall be of bronze construction, having a female thread coupler and a Buna "N" type seal. The couplings shall pass a hydrostatic test of 200 psig for sizes 3/4" through 2" and 150 psig for 3" sizes. The couplings shall have a temperature rating of 150°F for pressures of: 125 psig for 3/4" and 1-1/2" sizes; 100 psig for 2" size; and 75 psig for 3" size. The couplings shall be Dover Corporation/OPW Division dry disconnect coupling, adaptor Product No. 1631-D and coupler Product No. 1731-D, or approved equal.

2-9 SOLENOID VALVES: Supply and install solenoid valves where shown on the plans. Valves shall be normally closed and powered by 110 volt, 60 cycle, 1 Phase AC service with manual over-ride. Valves shall control flow at maximum pressure differential of a given service. Valves shall be provided with explosion-proof circuitry or housings in Class I areas. All solenoid valves shall be equipped with a waterproof hand-off-automatic switch located at the valve.

The valves shall be of the globe pattern with internal pilot assisted. All solenoid valves shall be equipped with adjustable dash pots to control the rate of closing to control hydraulic hammer.

For the comfort station solenoid valves shall be two way, normally closed construction, NEMA-1 enclosure, one-half inch pipe size, water service, brass body, teflon seat, packless, direct acting, 115 volts A.C.

2-10 HYDRANTS: Cast bronze, non-freeze with three quarter H.P.T. outlet, T-handle, polished face, integral vacuum breaker bronze wall casing, bronze operating parts, three quarter inch female and one inch male N.P.T. inlet connection.

2-11 AUTOMATIC TEMPERATURE AND PRESSURE RELIEF VALVE: A.S.M.E. National Board tested, bronze body, for water heater use.

2-12 TANK EMERGENCY SHUT-OFF VALVES: All above grade fuel storage tanks shall be equipped with a self closing ferrous body closing valve. The poppet shall be spring loaded to close and shall have high temperature seating material as Viton. The valve shall be set to close @ 160°F. The valve shall meet OSHA Standards and MFLR. The valve shall be OPW Steel Emergency Shut-off Valve OPW-177S or approved equal.

2-13 V PORT PLUG VALVE: All valves of this class shall be V port plug valves with a high rangeability for control of flows. The valve shall be DeZurik V Port Valve With Manual Operation And Lock or approved equal.

2-14 BACKFLOW PREVENTER:

A. Backflow preventers shall be made by a manufacturer regularly engaged in such manufacture. The Engineer reserves the right to approve or disapprove the adequacy of the backflow preventers proposed under these items. The backflow preventers shall operate properly to positively prevent backflow from the incoming water service line to the building or section water service line under all known pressure conditions.

B. The backflow preventers shall be of the spring loaded reduced pressure type. Operating pressure on the incoming water side shall not exceed 175 psi. Operating pressure on the outgoing water side shall be 40-60 psi.

C. Body of the backflow preventers shall be galvanized cast iron ASTM A-48 for size over two inches and bronze ASTM B-61 for smaller sizes. Working parts shall be bronze. Springs shall be plastic coated carbon steel or stainless steel. Valve discs shall be Neoprene.

D. Hydrostatic: Test pressure maximum 250 psi. Water temperature range will be 32 degrees Fahrenheit to 80 degrees Fahrenheit.

E. Backflow preventers shall be Clayton Model RP Backflow Preventer as manufactured by Cla-Val Company or approved equal.

2-15 EXTERIOR AND INTERIOR HOSE FAUCETS:

A. Exterior: Provide and install where indicated on the drawings three-fourths (3/4) inch polished brass non-freeze wall hydrants with loose handle key. Wall hydrants shall be Josam Series

1400-N or Blake L-1325, located eighteen (18) inches above finish grade. Provide a globe stop valve ahead of each wall hydrant.

B. Interior: Provide and install, where indicated on the drawings, one half (1/2) inch inlet and three fourths (3/4) inch hose, Chicago Faucet No. 13T or approved equal.

2-16 AIR AND VACUUM VALVES:

A. The air and vacuum valves shall be approved fully automatic type, designed to vent air from high points in pipe lines, and also to allow air to enter the pipe lines when vacuum conditions exist, to prevent tendency to pipe collapse. When air has been eliminated the air and vacuum valve shall close firmly and tightly to prevent leakage of water outward. Sizes shall be as shown on the drawings.

B. Air and vacuum valves shall be similar and equal to Crispin Air and Vacuum Valves, Type C, as manufactured by Multiplex Manufacturing Company, Berwick, Pennsylvania, or Air and Vacuum Valves as manufactured by Valve and Primer Corporation, Chicago, Illinois or approved equal.

2-17 AIR RELEASE VALVES:

A. Air release valves shall be approved fully automatic type, and designed to release air from air pockets accumulating at high points in pipe lines, and air pockets which will obstruct the flow of water. These valves shall be designed for venting of accumulated air while system is in service and under pressure. When air pockets are eliminated, air valves shall close firmly and tightly, preventing leakage of air inward and water outward. Sizes shall be as shown on drawings.

B. Air release valves shall be similar and equal to Crispin Air Valves, Type P, as manufactured by Multiplex Manufacturing Company, Berwick, Pennsylvania, or Air Release Valves as manufactured by Valve and Primer Corporation, Chicago, Illinois.

C. Air release valves for air removal from fuel transfer systems shall be Apco No. 200 AF or approved equal.

2-18 PRESSURE REDUCING AND PRESSURE SUSTAINING VALVE: This valve shall maintain a constant downstream pressure regardless of fluctuations in demand when the upstream pressure becomes equal to the spring setting of the pressure sustaining control of which the valve throttles to maintain a constant inlet pressure.

This valve shall be a hydraulically operated, pilot-controlled diaphram type globe valve. The main valve shall have a single removable seat and a resilient disc. The stem shall be guided at both ends by a bearing in the valve.

No external packing glands are permitted, and there shall be no pistons operating the main valve or any pilot controls.

The pressure reducing pilot control shall be a direct acting, adjustable spring-loaded, normally open diaphram valve which closes when downstream pressure exceeds the setting.

The pressure sustaining pilot control shall be a direct acting adjustable, spring-loaded, normally closed diaphram valve which opens when upstream pressure exceeds the spring setting. The control system shall include a fixed orifice ejector. The valve shall be Clayton Series 92-01 Combined Pressure Reducing and Pressure Sustaining Valve or approved equal.

2-19 SAMPLING COCKS: Sampling cocks shall be smooth nosed and either chrome plated or brass finish, of a type approved by the Michigan Department of Public Health.

2-20 MANUAL OPERATORS:

A. All valve shall have manual operators unless specified otherwise. For the rotating type valves having direct levers, gear operators shall be provided when the maximum torque requires an operating force greater than 50 pounds or as specified for that type of valve, whichever, is less; and also, for those installations where sudden opening or closing would cause possible damage to the system, such as high pressures from water hammer and filter media upsets.

B. All gearing, thread screws, traveling nuts, and linkages shall be enclosed in a gasketed, cast iron housing suitable for oil or grease lubrication. Seals shall be provided on all shafts to prevent entry of dirt and water into the actuator and loss of lubricant. All shafts shall be supported on permanently lubricated bronze bearings. Gear operators on valves for installation in plant or above ground shall be provided with position indicators and an operating nut for wrench operation in emergency. All exposed nuts, bolts, and washers shall be zinc or cadmium plated. Valves shall be delivered in factory standard finish paint. All manually operated valves 4 inch and larger, located 6'-0" or more above the floor, shall be equipped with gear and chain operators with the chain extending to 3'-0" above the floor.

C. All valves of the same size and for similar service shall be the same make and model with interchangeable components to minimize the spare parts inventory.

2-21 ELECTRIC MOTOR OPERATORS:

A. Contractor shall furnish and install as part of the particular item of equipment a suitable electric motor unit. They shall be of sufficient capacity to properly operate equipment under all operating conditions without exceeding the rating of the motor. All electric motor operators shall be equipped with waterproof automatic-open-close switches located at the valve

B. Unless specified otherwise, all motors shall be of a standard type, high efficiency, and in general use for such applications. They shall be the squirrel cage, self ventilation induction type, have moisture resistant Class "B" insulation, rated at 40 degrees Centigrade temperature rise above 40 degrees Centigrade ambient, and a minimum service factor of 1.15. They shall be built and tested in accordance with the current NEMA AIEE and ANSI Standards for 60 hertz, A.C. motors. The enclosures shall be open, drip-proof for indoor use and screened, weather-proof for outdoor use unless specified otherwise. The motors shall be provided with explosion-proof housing for use in Class I areas.

C. For major items of equipment, the Contractor shall furnish three (3) certified copies of the non-witness tests done in accordance with AIEE commercial test procedures.

D. Each motor shall be complete with the necessary base, couplings, guards, anchor bolts, and other details as the type of use may require.

PART 3: EXECUTION

3-1 VALVE INSTALLATION: Install valves of the size and type indicated in the locations shown on the drawings. All valves of the same size and type used for the same service shall be of the same make, having interchangeable parts.

3-2 VALVE OPERATORS: Install valves with operators of the types shown on the drawings. For manual operators, provide appropriate extensions to allow convenient operation of the valves.

3-3 STOP COCK: To be installed as shut-off for water supply.

3-4 SWING CHECK VALVES: To be installed at water blending valve.

3-5 PRESSURE AND TEMPERATURE RELIEF VALVE: To be installed on electric water heater with discharge piped to drain.

3-6 SOLENOID VALVES: To be installed in tempered water supply to each shower.

END

SECTION 15140 PUMPS

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing the following pumps the inline submersible pumps and discharge head, the finished water transfer pumps, the high service pumps, the backwash supply pump, the backwash waste pumps and the waste sludge - domestic waste pumps.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Underwater Construction (Water Intake) Section 02920, Intake Protection Equipment - Section 15420, Controls, Instrumentation and Alarms - Section 16900.

1-3 QUALITY ASSURANCE: References - American Society of Testing and Materials (ASTM) Hyraulics Institute.

1-4 INSPECTION: Shop Inspection: All materials furnished by the Contractor are subject, at the discretion of the Contracting Officer to inspection, testing and approval at the manufacturer's plant.

PART 2: MATERIALS

2-1 INLINE SUBMERSIBLE PUMPS AND DISCHARGE HEAD:

A. The two inline submersible pumps shall have a capacity of 80 gallons per minute each at a total dynamic head of 67 ft. at 40°F. The pumps shall be Layne, Model 4" RLC operated at 3,500 rpm, or approved equal.

B. Pump Bowl Assembly: The pump bowls shall be made of good grade cast iron, fitted with enclosed bronze impellers, a stainless steel shaft and water lubricated bearings.

C. Motor Adaptor: The motor adaptor for connecting the bowl assembly to the submersible motor shall be made of good grade cast iron. Nominal diameter shall not exceed that of the bowl assembly or motor. The screen shall be of non-corrodible material.

D. Electric Motor: A submersible motor, Franklin Motors or equal shall be included with the pump. Motor shall be of the "Wet" type construction with windings encased in plastic armor that is impervious to any water within the motor. Motor leads are to be permanently sealed into the windings. Stainless steel is to be used wherever possible to resist corrosion. Maximum speed and motor size shall be 2 horsepower at an operating voltage 220 volts, three phase, 60 Hz.

E. Cable: Three submersible type conductor cables shall be furnished and installed, using stainless steel clamps located a minimum of 10' apart. One extra foot of cable shall be supplied for each 50' of setting to allow for possible twist or sag during installation. A minimum of 10' of cable is to be supplied beyond the surface plate.

F. Control Box: A control box with heavy, rain tight enclosure is to be provided. Control box shall contain the starting capacitor, relay, quick trip overload device, motor data, a hand-off automatic switch and connection terminals.

G. Motor Centralizers: Stainless steel bolt on motor centering devices shall be provided. The devices shall be able to resist the starting torques and be so designed that the annual insertion and withdrawal of the pumps will not damage the polyethelene casing pipe.

H. Pump Discharge Pipe and Discharge Head: The 3 inch diameter pump discharge pipe shall be equipped with threaded couplings which are tack welded on one side and drilled and taped for three 3/16 inch stainless steel pointed set screws on the other side of the coupling. The tack welding and set screws are to prevent loosening of the coupling due to vibration and starting torque while allowing for the annual disassembly for winter mothballing. The discharge pipe shall contain a rubber seated check valve. The discharge head shall be equipped with a 11-1/4 degree elbow as shown on the drawings. Discharge head shall be provided for above ground mounting, with an integral discharge flange. Flange shall be 125/150 pound flat face type faced and drilled per ASA Standards. The discharge head shall be of sufficient size to span an opening in the supporting structure which shall permit removal of the complete pump unit connected below. Two lifting lugs shall be provided with capacity to support the weight of the entire pump. The discharge head mounting base shall be a round flange type with accurately machined surfaces.

2-2 FILTERED WATER TRANSFER PUMP:

A. The filtered water transfer pumps shall be close-coupled end suction horizontal centrifugal pumps. The high efficiency NEMA drip proof motor of 1 horsepower frame 56 at 1750 rpm shall have a stainless steel shaft. The pumps shall be designed for

90 gallon per minute at a total dynamic head of 28 feet.

B. The pumps shall be furnished with case wearing ring and a packing gland seal with stainless steel wear sleeves. The pumps shall be equipped with a hand-off automatic switch located at the pumps. The pump shall be Aurora Pump, 1 1/2 x 2 x 7, Model 321, with 220 V, 3 phase, 60 Hz. motor, or approved equal.

2-3 HIGH SERVICE SYSTEM PUMPS:

A. The two high service pumps shall be close coupled, horizontal end suction, vertically split single stage with closed impellers. The pumps shall have a rating of 140 gallons per minute at 185 feet (80 psi) total dynamic head at high pressure and 180 gallons per minute at 138 feet (60 psi) total dynamic heat at low low pressure. The pump shall be for potable water service at 65°F. nominal temperature. Each pump shall be equipped with a hand-off automatic switch located at the pumps. The pumps shall be Allis-Chalmers, Series 2000 2.5 x 2 x 9L operated at 3500 rpm or approved equal.

B. Pump Casings: Close-grained cast iron; thickness shall withstand all strains imposed upon pump for required service; shall withstand double required working pressures for which pump is designed. Castings: smooth and even. Horizontal pumps: vertical split; held together by bolted flanges which shall permit half to be unbolted and removed without disturbing suction and discharge connections. Inside of pump: readily accessible for examination and repair. Provide casings with proper openings for drains, priming openings and piping and seal water connections to packing glands; also provide large eye bolts to facilitate lifting. All casings and joints: machined accurately to gauge and doweled to perfect alignment and to permit close running fit of impellers.

C. Locate bearings outside pump casings proper. Design same so water leakage from stuffing boxes cannot enter them. Provide radial ball bearings, perfectly locked and sealed in housings, held in permanent alignment and removable as a unit with pump shaft without disturbing alignment of pump or driving unit. Bearings: turned exactly to gauge to facilitate duplication of parts. Provide adequately for end thrust. Provide bearings with oil reservoirs of ample capacity and drains, to permit drawing off oil and for flushing.

D. Impellers: all bronze, unless specified otherwise, correctly designed with stainless steel wear ring(s) accurately finished to gauge on sides and circumference. They shall provide perfect rotative balance when mounted on shafts, complete with all moving parts. Impellers: enclosed type; hydraulically balanced in approved manner to eliminate and thrust in double suction types.

E. Casing Wearing Ring(s): bronze, or stainless steel properly fitted to casings so as to be leakproof; interchangeable easily replaced when worn, wide section, machined to gauge and to fit the impeller ring(s), and have a Brinell Hardness of at least 50 less than that of the impeller ring(s).

F. Stuffing Boxes: large, deep; each box shall take from five (5) to six (6) rows of packing and bronze lantern water seal ring. Place bronze ring in bottom to prevent sticking of packing to box. Provide stuffing boxes with split type bronze glands, easily removable when repacking is necessary. Adjust glands with bronze swing bolts; and design which insures tight packing, without excessive friction on rotating shaft.

G. Pump Shafts: high grade carbon or alloy steel, of high tensile strength; straight, turned true, ground smooth to gauge, and sufficiently large to meet maximum working conditions required with a high factor of safety. Provide shafts with impeller lock nuts for holding impeller in place. Provide stainless steel shaft sleeves from impeller and through stuffing boxes of volute.

H. Provide pumps specified here with flanges for connection to flanged cast iron pipe and fittings. Flanges: conform to ANSI Specification B16.1 (Class 125).

I. Provide each volute, suction chamber, stuffing box, or other portion of each pump, which might trap air, with piping for connection to a priming system and water seal system, as shown on the plans.

J. Provide with each pump, an indicating pressure gauge on discharge nozzle and a vacuum gauge on suction nozzle as required to show operating pressures. Gauges: at least six (6) inches diameter Discharge gauges shall have intervals of gradation in both pounds per square inch and feet of head stamped on faces. Suction gauges graduated in inches of mercury vacuum. Equip each gauge with 1/4 inch brass stop cock to facilitate gauge removal and to dampen vibration of pointer. Mount gauges on horizontal pumps so that center of gauge will be at same height as center of pump shaft. Range of each gauge: as required by operating head range of each pump.

K. Provide approved, suitable electric motor for driving each pump. Rated horsepower of each electric motor: such that it exceeds brake horsepower requirement of connected pump when it is operating under specified design conditions, and is equal to at least 90 percent of brake horsepower of pump under any other pumping condition. Each electric motor for use with horizontal centrifugal pump shall be of sufficient power rating to properly operate pump, under all operating conditions, such as starting, constant load and service overload of 15 percent without exceeding 40 degrees centrigrade above standard ambient temperature. Mount motor directly on same bed plate as pumping equipment. Each motor: complete, with all necessary foundation, anchor bolts, mounting base, matching motor and pump coupling, ample capacity bearings, and all other details required by specific type of same. Electric motors: unless otherwise specified, motors shall be squirrel cage induction type, with following design features: normal starting torque, low inrush current or KVA, continuous operating power rating as required by pump, with 15 percent service factor and enclosed in drip-proof frame, all as per latest NEMA motor standards. Motor windings and other electrical portions of equipment: specially designed with impregnated insulation for operation in damp and moist location with rated operating voltage applied. Motor: suitable for use on 3 phase 60 Hertz, A.C. electric power supply. Motor shall be not less than 240 volt, 10 horsepower.

L. Mount horizontal pumps and motive units on substantial box type fabricated steel or cast iron base with drip plate made to suit each unit. Bolt and dowel pump and motive unit to bed plate to insure perfect alignment. Provide suitable bosses on each base to insure anchorage to foundation: provide sufficient anchor bolts to hold unit rigidly in place. Provide lips and drains to carry away leakage from stuffing boxes and keep floors dry. After being set, aligned, checked and tested, fill base plate for each pump with grout, as per manufacturer's instructions.

2-4 BACKWASH SUPPLY PUMP AND BACKWASH WASTE PUMP:

A. The backwash supply pump shall be a horizontal, end suction, vertically split single stage, centrifugal pump with closed impeller. The pump shall have a rating of 360 gallons per minute at 25 feet total dynamic head. The pump shall be for potable water at 65°F. nominal temperature. The pump shall be equipped with a hand-off automatic switch located at the pump. The pump shall be Allis-Chalmer, Series 2000, 6 x 4 x 9 operating at 1160 rpm or approved equal.

B. The backwash waste pump shall be a horizontal end suction, vertically split, single stage centrifugal pump with closed impeller. The pump shall have a rated capacity of 480 gallons per minute at 35 feet total dynamic head. The pump shall be for water at 65°F. nominal temperature. Each pump shall be equipped with a hand-off automatic switch located at the pumps. The pump shall be Allis-Chalmer, Series 2000, 6 x 4 x 9 operating at 1750 rpm or approved equal.

C. The above pump capacities and head have been determined based on the design criteria stated on Sheet 2 and a filter with 23.7 square feet of surface. If a filter with different area is supplied the capacities and discharge heads shall be recalculated.

D. Pump Casings: Close-grained cast iron; thickness shall withstand all strains imposed upon pump for required service; shall withstand double required working pressures for which pump is designed. Castings: smooth and even. Horizontal pumps vertically split; held together by bolted flanges which shall permit half to be unbolted and removed without disturbing suction and discharge connections. Inside of pump: readily accessible for examination and repair. Provide casings with proper openings for drains, priming openings and piping and seal water connections to packing glands; also provide large eye bolts to facilitate lifting. All casings and joints: machined accurately to gauge and doweled to perfect alignment and to permit close running fit of impellers.

E. Locate bearings outside pump casings proper. Design same so water leakage from stuffing boxes cannot enter them. Provide radial ball bearings, perfectly locked and sealed in housings held in permanent alignment and removable as a unit with pump shaft without disturbing alignment of pump or driving unit. Bearings: turned exactly to gauge to facilitiate duplication of parts. Provide adequately for end thrust. Provide bearings with oil reservoirs of ample capacity and drains, to permit drawing off oil and for flushing.

F. Impellers: all bronze, unless specified otherwise, correctly designed with stainless steel wear ring(s) accurately finished to gauge on sides and circumference. They shall provide perfect rotative balance when mounted on shafts, complete with all moving parts. Impellers: enclosed type; hydraulically balanced in approved manner to eliminate and thrust in double suction types.

G. Casing Wearing Ring(s): bronze, or stainless steel properly fitted to casings so as to be leakproof, interchangeable, easily replaced when worn, wide section, machined to gauge and to fit the impeller ring(s), and have a Brinell Hardness of at least 50 less than that of the impeller ring(s).

H. Stuffing Boxes: large, deep; each box shall take from five (5) to six (6) rows of packing and bronze lantern water seal ring. Place bronze ring in bottom to prevent sticking of packing to box. Provide stuffing boxes with split type bronze glands, easily removable when repacking is necessary. Adjust glands with bronze swing bolts; and design which insures tight packing, without excessive friction on rotating shaft.

I. Pump Shafts: high grade carbon or alloy steel, of high tensile strength; straight, turned true, ground smooth to gauge, and sufficiently large to meet maximum working conditions required, with a high factor of safety. Provide shafts with impeller lock nuts for holding impeller in place. Provide stainless steel shaft sleeves from impeller and through stuffing boxes of volute.

J. Provide pumps specified herein with flanges for connection to flanged cast iron pipe and fittings. Flanges: conform to ANSI Specification B16.1 (Class 125).

K. Provide each volute, suction chamber, stuffing box, or other portion of each pump, which might trap air, with piping for connection to a priming system and water seal system, as shown on the plans.

L. Provide with each pump, an indicating pressure gauge on discharge nozzle and a vacuum gauge on suction nozzle as required to show operating pressures. Gauges: at least six (6) inches diameter. Discharge gauges shall have intervals of gradation in both pounds per square inch and feet of head stamped faces. Suction gauges graduated in inches of mercury vacuum. Equip each gauge with 1/4 inch brass stop cock to facilitate gauge removal and to dampen vibration of pointer. Mount gauges on horizontal pumps so that center of gauge will be at same height as center of pump shaft. Range of each gauge: as required by operating head range of each pump.

M. Provide approved, suitable electric motor for driving each pump. Rated horsepower of each electric motor: such that it exceeds brake horsepower requirement of connected pump when it is operating under specified design conditions, and is equal to at least 90 percent of brake horsepower of pump under any other pumping condition. Each electric motor for use with horizontal centrifugal pump shall be of sufficient power rating to properly operate pump, under all operating conditions, such as starting, constant load and service overload of 15 percent without exceeding 40 degrees centrigrade above standard ambient temperature. Mount motor directly on same bed plate as pumping equipment. Each motor: complete, with all necessary foundation, anchor bolts, mounting base, matching motor and pump coupling, ample capacity bearings, and all other details required by specifi type of same. Electric motors: unless otherwise specified, motor shall be squirrel cage induction type, with following design features: normal starting torque, low inrush current or KVA, continuous operating power rating as required by pump, with 15 percent service factor and enclosed in drip-proof frame, all as per latest NEMA motor standards. Motor windings and other electrical portions of equipment: specially designed with impregnated insulation for operation in damp and moist location with rated operating voltage applied. Motor: suitable for use on 3 phase, 60 Hertz, A.C. electric power supply. Motors shall be not less than 240 volt, and 3 horsepower for backwash supply pump and 7.5 horsepower for backwash waste pump.

N. Mount horizontal pumps and motive units on substantial box type fabricated steel or cast iron base with drip plate made to suit each unit. Bolt and dowel pump and motive unit to bed plate to insure perfect alignment. Provide suitable boxes on each base to insure anchorage to foundation: provide sufficient anchor bolts to hold unit rigidly in place. Provide lips and drains to carry away leakage from stuffing boxes and keep floors dry. After being set, aligned, checked and tested, fill base plate for each pump with grout, as per manufacturer's instructions.

2- 5 DUPLEX GRINDER PUMP UNIT:

A. General:

1. Description: This specification covers the furnishing and installation of prefabricated grinder pump stations with parts and equipment installed in a fiberglass reinforced polyester tank. The grinder pump station shall be as manufactured by a manufacturer regularly engaged in the fabrication of grinder pump stations of the type and size specified.

The work includes furnishing all materials, equipment, and labor, excavation and backfill, dewatering, replacement or repair of damaged utilities, seeding and sodding, and all work considered incidental to the construction of grinder pumping stations as hereinafter specified, and as shown in the drawings. The stations shall be be completed with all specified and necessary equipment for proper operation.

2. Pump: The grinder pump shall be capable of reducing all components in normal domestic sewage, including a reasonable

amount of "foreign objects" such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and discharge piping. The pump and grinder shall be specifically designed for this application and be a vertical, submersible, motor-driven, solids handling unit. The grinder and impeller shall be accurately balanced and securely fastened to the pump motor shaft. The pump shall be provided with two mechanical shaft seals to prevent leakage to the motor and be oil lubricated. The lower seal shall have a ceramic face or equal and the upper seal a carbon face, both seals to be precision lapped and held in position by a stainless steel spring.

3. Grinder: The grinder shall be positioned immediately below the pumping elements and shall be direct-drive by the same motor. The grinder will be of the rotating type with a stationary hardened and ground stainless steel shredding ring spaced in accurate close annular alignment to the driven impeller assembly, which shall carry the hardened precision made stainless steel cutter bars. This assembly shall be dynamically balanced and run without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be positioned in such a way that solids are fed into it from the bottom in an up-flow direction, such that there can be virtually no possibility of gravity-caused overloading or jamming.

4. Electric Motor: The submersible motor shall be a squirrel cage induction type with low starting current and high starting torque characteristics. The pump shall be capable of running dry continuously in a totally dry condition, or shall be protected by an automatic reset integral thermal overload protector incorporated into the motor. Before final acceptance, a field running test demonstrating this ability shall be performed for all pumps being supplied, if required. The motor shall be capable of continuous duty at maximum rated pressure without tripping the thermal overload, or exceeding Underwriter's Laboratories temperature limits. The submersible type motor shall be constructed to operate in clean dielectric oil for cooling winding and lubricating bearings. The integral motor and pump shaft shall be of a stainless steel supported by an upper ball radial and thrust bearing and a lower bronze sleeve bearing or equal.

Pump and motor housings to be of high quality cast iron or equal.

All fasteners to be of stainless steel or equal.

5. Valves and Piping:

a. General: the discharge piping shall include a check valve designed for this type of service, and a shut-off valve with handle extension for each pump. Discharge piping for each pump shall be 1-1/4" with NPT couplings. All piping external to the station shall be furnished and installed by others.

b. Anti-Siphon Feature: The pump shall be equipped with a check valve or vacuum break which shall prevent a suction being applied to the stator, then the piping shall have an "anti-siphon feature".

Each pump station shall be constructed with a positively flooded suction configuration. As assurance that the pump cannot lose prime under the above described negative pressure (suction) conditions in the discharge piping system, the pump shall be equipped with an integral anti-siphoning air relief valve in the discharge piping just below the main check valve. This valve will automatically close when the pump is running and open to atmosphere when the pump is off.

c. Redundant Check Valve: When the grinder pump station discharges to a collector force main as shown on the plans, then each grinder pump station shall be shipped with one check valve for installation in the discharge line between the grinder pump and the force main to insure maximum protection against backflow.

These valves, being 1-1/2 inches or smaller, shall be brass and hav a gravity operated swing type brass flapper suitable for a minimum working pressure of 125 psi. The flapper shall have a stop preventing it from sticking in the open position.

6. Tank: The tank shall be custom molded of fiberglass reinforced polyester resin using a lay-up and spray technique which will assure that the interior surface is smooth and resin-rich. The tank shall have a minimum net operating capacity of 60 gallons for each pump. The tank shall be furnished with PVC closet flanges providing one or two sockets as shown on plans to accept 6" nominal diameter drain-waste-vent (DWV) piping. These socket fittings shall be assembled to the tank using rubber gaskets and stainless steel fasteners or equal.

The tank shall have an integral weatherproof cover with a minimum width of 24 inches sealed to it at the factory. The tank cover shall be suitably gasketed and bolted in place. The cover shall have a hasp and padlock keyed to the Owner's master. The cover shall be constructed either of fiberglass reinforced polyester resin as described above for the tank, or 1/4 inch thick fabricated steel. For corrosion protection, both inside and out, the steel cover shall be sand blasted and then painted with two coats of tar base epoxy paint.

The tank thickness required is the minimum capable of withstanding the soil loadings at the depths shown on the drawings plus water pressure assuming the groundwater level is at the surface of the ground. The tank shall have provisions for anchoring it to concrete as shown on the plans to withstand the buoyancy uplift. Lifting devices shall be furnished as part of the tank for the installation of the assembly. The manufacturer shall certify that the tank is designed to meet these conditions.

7. Controls: Each pump shall be automatically operated to start at high level and stop at low level, keeping the pump submerged. Duplex (2 pumps) installations shall be designed to cause the pumps to alternate each pumping cycle and in the event that either of the pump's discharge is less than the inflow, the second pump will operate before the high water alarm is sounded. The high water alarm shall be independent from the pump control system for fail safe operation.

The level sensing devices shall be either by air-bell and pressure switches or by mercury tube float switches. The air-bell system shall have air-tight tubing from the air-bell to a pressure switch for an air-tight system having no sewage entering the air tubing.

The float type mercury tube switches shall be sealed in a solid polyurethane float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket and a weight shall be attached to the cord above the float to hold the switch in place in sump. The weight shall be above the float and designed to prevent sharp bends in the cord when the float operates under water. The float switches shall hang in the sump supported only by the cord that is held to the NEMA IV junction box or the wiring channel. For duplex systems, three float switches shall be used to control level, one for pump turn-on, one for pump turn-off, and one for both pumps turn-on. A fourth switch shall be provided for high water alarm control. For simplex systems, two float switches shall be used to control level, one for pump turn-on and one for pump turn-off. A third switch shall be provided for high water alarm control.

The equipment shall be designed for a 1 phase, 240 volt, 3 wire, 60 Hertz power supply and will be furnished with type UF cable, prewired, and connected with weatherproof materials to a junction box on the exterior of the manway. A cable shall supply power for each pump and a separate signal lead for the high water alarm.

The control panel shall have a NEMA IIIR weatherproof enclosure. A hasp with lock keyed to the Government's master shall be provided on the door. A circuit breaker and a magnetic starter with 1 leg overload protection for single phase operation shall be supplied for each pump. H-O-A switches and run lights shall be supplied for each pump. Terminal strip shall be provided for connecting pump and control wires. Additional terminals shall be provided for connecting pump and control wires. Additional terminals shall be provided to connect alarm. All controls, alarms and wiring shall comply with the Local, State and National electric codes. Components shall be of standard production and U.S. approved.

The alarms shall consist of a flashing red 100 watt light and a horn with silencer switch in a weatherproof enclosure. They shall be in a visible location such as in the roadway right-of-way. The alarms shall be furnished by the manufacturer of the pump control panel. The alarms shall be on an independent circuit with separate conduit and circuit breaker for fail safe operation.

8. Corrosion Protection: All materials exposed to sewage shall have inherent corrosion protection; i.e., cast iron, fiberglass, stainless steel, PVC. Any exterior steel surfaces are to be suitably protected against corrosion.

B. Semi-Positive Placement Type Pump: The semi-positive displacement type of grinder pump provided shall be capable of delivering a minimum of 11 gpm against the rated total dynamic head of 81 feet. At zero head, the output shall be at least 15 gpm. The pump shall be capable of intermittent operation at 40% above its normal rated dynamic head. The pump shall be of the progressing cavity type. The rotor shall be stainless steel with a hard chrome finish or equal.

The stator shall be of a specially compounded synthetic elastomer of superior mechanical and chemical properties under intended service conditions with a rated life expectancy of not less than 1500 hours as determined by elapsed time meters on each pump.

The capacitor start motor shall be a minimum of 1 horsepower and operate at 1725 rpm.

The grinder pump station shall have a unit construction cartridge type removable core unit consisting of pump, motor, grinder, controls, check valve and wiring.

PART 3: EXECUTION

3-1 Furnish and install pumps as shown on the Drawings.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a marine holding tank pump-out station and related electrical work.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Galvanized steel pipe - Section 15071; general electrical provisions - Section 16010.

PART 2: MATERIALS

2-1 MARINE HOLDING TANK PUMP-OUT STATION: The pump-out station shall be the Sani-Station, Model SS100E, manufactured by Clear Water, Inc., 227 N. Main Street, Walworth, Wisconsin 53184, or approved equal. The pump-out unit shall consist of the following:

A. Pump and Drive: The pump shall be an 8-inch diaphragm type unit with 1-1/2-inch threaded suction and 2-inch discharge connections. It shall be capable of pumping up to 20 gpm, depending upon the speed of the drive unit. The pump shall provide up to 20 feet suction lift and up to 20 feet discharge head.

It shall be made of heavy close-grained cast iron with reinforced rubber diaphragm.

The motor shall be a 1/2 hp, 1,750 rpm, 115/230 volt, single phase, 60 cycle drip proof or explosion proof, horizontal motor, close-coupled to a gear reducer drive having a 30:1 gear ratio. The gears shall be of the worm type.

B. Hose and Reel: The hose reel shall be of the crank type, capable of holding 50 feet of 1-1/2-inch heavy duty type reinforced vacuum hose. It shall have 1-1/2-inch connections both for the hose and the piping into the suction piping. The reel shall be of fabricated steel and painted with a coating of rust resistant enamel. The crank shall be easily removed for safe storage when not in use.

The hose shall be 40 feet long and it shall be of the light weight flexible, heavy duty vacuum type, collapse-proof and non-kinking.

There shall be a clear sight glass furnished of the same size as the pump suction installed in the suction line at or near the suction connection.

The suction connection shall fit all standard boat waste fittings and shall be constructed of molded neoprene rubber with brass insert. The suction connection shall contain an automatic drip proof valve at extreme inlet end.

C. Rinse Line and Nozzle: There shall be 75 feet of 3/8-inch high pressure, self-storing plastic rinse line and a storing chamber constructed as an integral part, furnished with the pump-out station. It shall be easily accessible through the top of the housing and have a grip type nozzle for use during the pump-out.

D. Frame and Housing: The frame for the complete unit shall be fabricated of 3/16-inch by 1-1/4-inch carbon steel, welded and painted with a coating of rust resistant enamel. The over-all frame shall be large enough to accommodate the pump and drive reel and inter-connecting piping. On the suction line inlet side of the housing, there shall be four rollers bolted in place to the frame to protect the hose during pull-out and re-winding. The width of these rollers shall be as wide as the inside width of the reel to facilitate full use of the reel capacity.

The housing shall be of molded fiberglass, formed in two pieces and bolted to the frame. The housing shall be easily removable by loosening four cap screws when maintenance is required. All corners shall be rounded with a minimum 1/4-inch radius. The over-all dimensions shall be approximately 33 inches wide by 30 inches long by 33 inches high.

The connecting piping inside the housing shall be standard weight plumbing fittings, flexible hose and stainless steel clamps, all minimum 1-1/2-inch size and shall be completely assembled and tested prior to leaving the factory.

The total weight of the complete unit shall be approximately 260 pounds.

E. Identification: There shall be two emblems approximately 11 inches by 14 inches in size affixed to opposite sides of the pump-out station to identify the unit. The emblems shall, by means of a prominent white inverted arrow, indicate the availability of the pump-out service. In addition, the manufacturer shall furnish one steel sign of 24-inch by 30-inch size, similar to the unit emblem, to the Contractor to install as directed. The signs shall be double-faced enamel and identify the unit and its purpose, subject to approval by the Contracting Officer.

F. Manual: A complete operational manual and repair parts list shall be included with each unit.

PART 3: EXECUTION

3-1 Install the pump-out station as shown on the drawings. The exact location of the pump-out station will be determined by the Contracting Officer.

3-2 Connect the pump-out station to the galvanized steel discharge line, water line and make electrical connections required for operation.

Electrical connections include installing conduit as shown on the drawings and wiring from the pump-out station to the power panel.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of furnishing and installing all pumps as specified and as shown on the drawings. Included in this section are the furnishing and installation of the necessary accessories and appurtenances required to provide a complete pump installation in accordance with applicable codes and standards.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Pipe and Pipe Fittings - Section 15060.

1-3 QUALITY ASSURANCE: Reference, Michigan Flammable Liquids Code, 1973; Code of Federal Regulations, Title 29, Part 1910, Subpart H, Section 1910.106; U.S. Coast Guard Regulations for Marine Fuel Service Stations, Underwriters Laboratories.

PART 2: MATERIALS

2-1 FUEL DISPENSING PUMPS: All dispensing pumps to be furnished new shall be of the same make and model as existing equipment. Pumps shall have U.L. approved 1/4 horsepower, 1725 rpm, 115 volt motor with thermal overhead. Motor must be capable of starting and operating reliably at 80 volts. Pumping unit shall be direct-drive 5-vane rotary type capable of delivering 14 to 15 gpm. Pump shall contain a bronze 1 inch nutating disc meter with large numeral registers which records individual deliveries to 100 gallons, with a 100,000 gallon totalizer. The pump shall be equipped with a check valve with pressure relief located in the base casting. Pump shall have a 3/4 inch service station type nozzle with 12 feet of 3/4 inch, U.L. labeled hose and inline 25 micron filter. Pumps shall be mounted on pedestals with 2 inch standards and cast iron base with 1 inch bolt circles. The unit shall stand 55 inches high. The pump shall be Gasboy Model 1850 as manufactured by William M. Wilson & Sons, Inc., Lansdale, Pennsylvania, or approved equal.

A. Safety Service Valve: Normally open valve shall seal upon impact or at 160°F. Valves shall be U.L. listed.

B. Pressure Regulating Valve: Valves shall permit normal air elimination during normal operations, and shall serve as a safety shut-off valve in the event of pipe breakage above the valve.

C. The fuel dispensing pumps which are to be relocated shall be completely checked and any leaking, O-rings, seals or gaskets shall be replaced. The metering gears shall be verified for the correct metering of the fuel being dispensed at the new service. New standard cast iron bases shall be provided to make the units 55 inches high. The existing covered hose reels shall be maintained.

PART 3: EXECUTION

3-1 DISPENSING PUMPS:

A. New Pumps: Furnish and install dispensing pumps in the locations shown on the drawings with pressure regulation and safety/service valves.

B. Existing Pumps To Be Relocated: Remove existing pumps shown on the drawings and relocate as indicated. Provide safety/service valves and pressure regulating valves as required on relocated units and on the pump dispensing units which are to remain in place.

C. Schedule of Dispensing Pump Locations:

Mott Island:

1. Relocate gasoline dispensing pump with covered reel to small craft dock.

2. Relocated gasoline dispensing pump with covered reel to power house.

3. New diesel fuel dispensing pump with 12' hose at power house.

Rock Harbor:

1. New diesel fuel dispensing pump with 12' hose at incinerator.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of providing all meters and gauges as shown on the drawings and as specified herein. The equipment includes flow meters, elapsed time meters and pressure gauges.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Tanks - Section 15175, Controls, Instrumentation and Alarms - Section 16900.

1-3 QUALITY ASSURANCE: Equipment installed under this section shall be listed by Underwriters Laboratory, Inc. and United States of America Standards Institute (USASI) for the purpose required by these specifications.

PART 2: MATERIALS

2-1 INDICATING PRESSURE AND VACUUM GAUGES:

A. Indicating pressure and vacuum gauges shall be furnished and installed at the location, where shown on the drawings or where specified for each respective equipment item.

B. Indicating pressure gauges shall be direct reading, graduated in pounds per square inch and kilograms (force/square centimeter) and shall have a dial face of not less than six and one half (6 1/2) inches. A ground key stop cock and pulsation damper shall be installed between the gauges and the point of connection where shown on the plans or specified. Piping from gauges to point of connection shall be one-fourth (1/4) inch copper pipe. Accuracy shall be within 1/2 of one percent of scale range. Pointer shall be the adjustable micrometer type and shall be readily accessible from front of gauge regardless of mounting.

The gauges in general shall have the following ranges depending on pressures of the system to be gauged:

0-30 in Hg (0-762 mm Hg)
0-15 psi (0-1 Kg/Cm2)
0-60 psi (0-4.5 Kg/Cm2)
0-100 psi (0-7.5 Kg/Cm2)

C. Materials for gauge interior shall be as follows:

1. Non Corrosive Locations:

Bourdon tube - SAE 4130 Alloy Steel
Socket - SAE 1019 Steel
Tip - SAE 1020 Steel
Movement - Rotary Geared Nylon

2. Corrosive Locations:

Bourdon tube - 316 Stainless Steel
Socket and Tip - 316 Stainless Steel
Movement - 316 Stainless Steel

Gauges shall be similar and equal to those manufactured by Ashcraft Industrial Instruments, Stratford, Connecticut, or Marshalltown Precision Instruments, Marshalltown, Iowa.

2-2 PLASTIC INSERT FLOW METERS:

A. The plastic insert flow meter shall be constructed of fiberglass reinforced polyester with the fiberglass content not less than 30% by weight.

B. The throat of the insert flow tube shall be Type 304 stainless steel.

C. The mounting flange shall be protected by a corrosion resistant coating.

D. The insert tube meters shall be accurate to ± 1%.

E. An insert type flow tube shall be supplied to produce a differential pressure with miminum head loss and shall be suitable for metering the following flows.

Backwash 300 to 400 gpm

The insert tube shall be: Backwash 6 inch x 3.820 throat

The entrance shall be nozzle type, the radius of which shall be continuous with the throat section. There shall not be any protrusion, exposed sharp edged annulus, slot or other sediment collecting area exposed to the flow stream.

The pressure connections are to be 1/4 inch NPT female located 180° apart on the horizontal axis. The flow tube shall be Fisher nad Porter, Series 10F1060 low head loss, plastic insert or approved equal.

2-3 FLOW INDICATOR FOR PLASTIC INSERT TUBES:

A. The flow indicator shall be a metallic bellow differential pressure instrument which indicates the flows.

B. The flow meter indicator shall be of differential pressure measuring type and shall indicate for the backwash meter. The flow meter shall be mercuryless employing a stainless steel bellow in a steel housing with 2000 psi rating.

The instrument shall be fiberglass with stainless steel leakages. The flowmeter shall indicate flow rate on a 5 inch segmental scale. The flowmeter shall be Fisher and Porter Type 10B1521 with fiberglass case suitable for wall mounting.

2-4 PROPELLER FLOW METERS:

Meters to be of the propeller type and shall be furnished with flanged tubes, faced and drilled 150 #ANSI meter tube to be furnished with full length straightening vanes, radially spaced 120 degrees apart. Meter tubes to have the same nominal inside diameter throughout its length and be line with neoprene or equal to offer minimum obstruction to flow. Meterhead to be connected to the tube by means of a flanged connection, designed for each removal from the tube for inspection or repair. Meterhead to have cover plate of close grain high tensile cast iron, with propeller gear box of cast bronze. Meterhead to be furnished with conical propeller, mounted traversely in the center of the meter tube.

The meterhead shall be designed to handle thrust at the front of the propeller support assembly. The meter transmission shall be completely sealed from water pressure and shall operate from the propeller by means of radial Alnico magnets or approved equal. The meterhead shall be furnished with a six-digit direct-reading totalizer, registering in units of 100 gallons, together with a rate of flow indicating dial reading in units of 10 gallons per minute. The flow indicating dial shall be suitable for the following normal flow ranges: influent meter, 40 to 160 gpm; finished water meter, 100 to 330 gpm.

The register dial shall be protected by suitable hinged cover complete with locking hasp. The meter shall register within two percent (2%) of the true flow of water at all flows above minimum rating. The flowmeters shall be Sparling Series 100 flanged tube meters, or approved equals,of the following sizes: influent meter, 3" size; finished water meter, 4" size.

PART 3: EXECUTION

3-1 INDICATING PRESSURE AND VACUUM GAUGES:

All indicating pressure and vacuum gauges shall be installed as shown on the Contract Drawings and in a manner so the gauges may be easily read.

3-2 FLOW INDICATOR FOR PLASTIC INSERT TUBES:

The flow indicator for the plastic insert tube shall be installed as shown on the Contract Drawings and in a manner so the instrument may be easily read from an eye level of five feet.

3-3 PROPELLER FLOW METERS:

Propeller flow meters shall be installed as shown on the Contract Drawings and in a manner so the totalizer and indicating dial may be easily read from an eye level of five feet.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of the furnishing and installation of new, welded steel fuel storage tanks and day tanks, the cleaning and installation of existing fuel storage tanks, the furnishing of the water storage tanks, the hydropneumatic tank, and the backwash waste tank.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Controls, Instrumentation and Alarms - Section 16900; Excavation - Section 02220; Finishes - Division 9, Concrete - Division 3.

1-3 QUALITY ASSURANCE: References, American Petroleum Institute (API), American Welding Society (AWS), and National Fire Protection Association (NFPA), American Society of Mechanical Engineer's Boiler and Pressure Vessel Code, Federal Drug Administration (FDA), United States Drug Administration (USDA).

A. Shop Inspection: All materials furnished by the Contractor are subject, at the discretion of the Contracting Officer, to inspection and approval at the manufacturer's plant.

B. Weld Inspection: Welds shall be inspected in accordance with API Standard 650, at the manufacturer's expense, and copies of inspection reports shall be furnished to the Contracting Officer.

C. Acceptance: Before acceptance, all work shall be completed to the satisfaction of the Contracting Officer, and the entire tank, when filled with fuel, must be tight and free from leaks.

PART 2: MATERIALS

2-1 WELDED STEEL TANKS FOR FUEL STORAGE: New tanks shall be prefabricated, welded steel tanks constructed in accordance with API Standard 650 and Michigan Flammable Liquids Regulations, 1973. All openings and appurtenances, such as ladders, manholes, vents, outlets, drains, etc., shall be in accordance with the drawings and API Standard 650.

2-2 DAY TANKS: New day tanks shall be constructed of steel having a minimum thickness of No. 14 U.S. Standard Gauge and a minimum weight of 3.125 pounds per square foot. The capacity of day tanks shall be 270 gallons each. Day tanks are to be vented in accordance with the Michigan Flammable Liquids Regulations, latest edition.

2-3 TANK FINISHES: See Division 9, Section 09904.

2-4 VENTS: All tanks shall include normally closed pressure vacuum activated 2" vent and conform to the requirements of NFPA Code 30. Vent shall be OPW 523 with 12 oz. pressure setting and 1/2 oz. vacuum or approved equal.

2-5 EMERGENCY VENTS: The fuel storage tanks of 1,500 gallons or greater shall be equipped with emergency vents which shall be located as shown on the drawings. The vent shall be eight inch in diameter and conform to NFPA Code 30. The vent shall be OPW 202-F or approved equal.

2-6 HYDRO-PNEUMATIC TANK:

A. The 3,000 gallon hydro-pneumatic steel tanks shall be manufactured in accordance to American Society of Mechanical Engineer's Boiler and Pressure Vessel Code for 150 psi pressure and tested to 1-1/2 times the pressure rating, however, the tank shall not be a stamped or certified pressure vessel. The manufacturer shall document that the vessel has been tested. The tank shall be constructed with the openings and connections indicated in the drawings.

B. Hydro-Pneumatic Tank Accessories:

1. The tank manufacturer shall supply the ladder with provisions for field fastening the ladders to the tank without effecting the strength of the tank by requiring field welding directly to the tanks.

2. Tank supports shall be provided; the design of the supports where connected to the tank or to the concrete foundation shall make provisions for thermal expansion which will result from winter temperatures of -25°F. to sun heated summer temperatures of 125°F.

3. A heavy duty plastic sight gauge with a red ball float shall be provided. The visable gauge length shall be 12" long minimum and installed as shown on the drawings.

2-7 FINISHED WATER STORAGE TANKS:

A. General: The finished water storage tanks shall provide not less than 50,000 gallons of tank volume. The storage shall be provided in not less than two tanks nor more than four tanks. The determination of final size and number shall be based on costs related to economical and practical shipping. Designs are based on two tanks, however, if at the option of the Contractor, more than two tanks will be used there shall be no additional costs to the Government for piping, valves, controls and revised design required.

B. The fiberglass reinforced plastic resin tanks shall be filament wound with smooth resin rich inner surface. The resin shall be premium grade FDA and USDA approved vinyl ester resin in corrosion resistant barrier, with Isophthalic polyester in filament would layer. The finished tank shall be steam cured for four hours.

C. The two tanks as illustrated in the drawings have a capacity of 25,785 U.S. gallons each full and are 144 inch diameter by 336 inches straight side and 384 inches overall length and are Resin-Fab, Model H-144-25,785 as manufactured by Process Equipment Corporation, Belding, Michigan, or approved equal.

D. Fiberglass Tank Fittings and Accessories: The tanks shall each be fabricated with the following accessories as shown on the drawings.

1. Manhole: 20 inch diameter with 24 inch diameter cover.

2. Fittings:

a. 6 inch diameter, ANSI 125 pound drilled flanged outlet.

b. 4 inch diameter ANSI 125 pound drilled flanged inlet.

c. 6 inch diameter mitered vent with stainless steel screen across the vent. The screen shall be fine mesh with openings not larger than 100 micro and with sufficient area to provide proper venting.

d. 2 inch half coupling for level probe.

3. Tank Support Saddles: Six per tank of 10 gauge steel with epoxy coating.

4. Ladder: An OSHA approved ladder with safety cage, top handrail and non-skid top surfaces.

5. Tank Level Gauge: A permanently embedded series of gradations shall be incorporated into the surface of the tank which will give gradations in 500 gallon increments or less.

6. Lifting Lugs: Heavy steel cadmium plated lifting lugs and hold downs shall be embedded into the sides of each tank.

E. Backwash Waste Tank: The backwash waste tank shall provide not less than 1,500 gallons of tank volume and shall be constructed of steel having a minimum thickness of 3/16 inch. The tank shall be installed with the ladder, access manhole, vents, supports and pipe opening as shown on the Contract Drawings.

2-8 AVIATION FUEL STORAGE TANK

A. General: The finished aviation fuel storage tank shall provide not less than 5,000 gallons of tank volume, and shall be constructed in accordance with API Standard 650 and Michigan Flammable Liquids Regulations, 1973. All openings and appurtenances, such as ladders, manholes, vents, outlets, drains, etc., shall be in accordance with the drawings and API Standard 650.

B. The fiberglass reinforced plastic resin tank shall be filament wound with smooth resin rich inner surface. The resin shall be premium grade FDA and USDA approved vinyl ester resin in corrosion resistant barrier, with Isophthalic polyester in filament wound layer. The finished tank shall be steam cured for four hours.

C. The tank as illustrated in the drawings has a capacity of 5,138 U.S. gallons full and 1,594 inches diameter by 156 inches straight side and 186 inches overall length and are Resin-Fab Model H-94-5138 as manufactured by Process Equipment Corporation, Belding, Michigan, or approved equal.

D. Fiberglass Tank Fittings and Accessories: The tanks shall each be fabricated with the following accessories as shown on the drawings.

1. Manhole: 20 inch diameter with 24 inch diameter cover.

2. Fittings:

   a. 2" NPT half coupling

   b. 4" Gooseneck style vent with screen.

E. Tank Support Saddles: Two welded steel saddles to support tank 10 to 12" above floor.

3. Ladder: An OSHA approved ladder with safety cage, top handrail and non-skid top surfaces.

4. Additional Features: Ultraviolet absorber over outer gel coat.

5. Lifting Lugs: Heavy steel cadmium plated lifting lugs and hold downs shall be embedded into the sides of each tank.

PART 3: EXECUTION

3-1 WELDED STEEL TANKS FOR FUEL STORAGE:

A. New Tanks: Furnish and install new tanks in the sizes and at the locations shown on the drawings.

B. Existing Tanks to be Relocated:

1. Tanks To Be Used For Storing The Same Material As Was Previously Stored: Install the tanks, which are to be removed from their present locations in accordance with the Demolition Section. Install tanks in the locations shown on the drawings.

2. Tanks To Be Used To Store Different Material From That Previously Stored: Where an existing tank is to store a different material than was previously stored in the tank, clean the tank prior to installation at the new location. Cleaning shall be done by draining the tank, air drying with compressed air, scrubbing with industrial strength cleaner while forced-air ventilating, rinsing and air drying with compressed air. After cleaning, the new finishes shall be applied and install tank as shown on the drawings.

3-2 DAY TANKS: install day tanks as shown on the drawings. Exact locations of day tanks for Rock Harbor lodge units will be determined in the field.

3-3 HYDRO-PNEUMATIC TANK: Tank shall be installed as shown on the drawings and in compliance with the manufacturer's written instructions. Controls and other accessories shall be installed as required by other sections.

3-4 FINISHED WATER STORAGE TANKS: Tanks shall be installed as shown on the drawings and in compliance with the manufacturer's written instructions. Controls and other accessories shall be installed as required by other sections.

3-5 BACKWASH WASTE TANK: Backwash waste tank shall be installed as shown on the Contract Drawings.

3-6 AVIATION FUEL STORAGE TANK: Tanks shall be installed as shown on the drawing and in compliance with the manufacturer's written instructions. Controls and other accessories shall be installed as required by other sections.

END

PART 1: GENERAL

1-1 DESCRIPTION: Furnish insulation for hot, cold and tempered water piping, No piping is to be insulated until tested and approved for tightness.

1-2 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM), National Fire Protection Association and Underwriters Laboratories (U.L.).

PART 2: MATERIALS

2-1 INSULATION: Glass fiber one half inch thickness.

2-2 JACKET: Paper laminate permanently fire and smoke resistant.

2-3 FIRE HAZARD RATING: Insulation to have composit (insulation, jacket and adhesive) Fire and Smoke Hazard ratings as tested under procedure ASTM E-84, NFPA-25 and UL 723 not exceeding Flame Spread of twenty-five and Smoke Developed of fifty.

2-4 ACCESSORIES: To have same component ratings as in 2-3 above.

PART 3: EXECUTION:

3-1 INSULATION: To be applied on clean, dry surfaces.

3-2 INSULATION: To be continuous through wall and ceiling openings and sleeves.

3-3 INSULATION: To be applied with a continuous unbroken vapor seal. All surface finishes to be extended to protect all surfaces, ends, and raw edges of insulation.

3-4 GALVANIZED METAL SHIELDS: To be applied between hangers or supports and the insulation. Shields shall be formed to fit the insulation and extend up to the centerline of the pipe and shall be six inches long.

3-5 FITTINGS & VALVES: To be insulated and finished with insulating and finishing cement to a thickness equal to the adjoining insulation. Fittings to be additionally finished with four ounce glass cloth smoothly adhered and coated with approved adhesive.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing all of the control for the high service pumps including the safety valving on the hydro-pneumatic tank, alarms, the combination starters for the pumps, the air compressor tanks, the air piping, regulator valves, flow indicator, float check, needle valve.

Work not included in this section is the hydro-pneumatic tank, and the high service pumps and motors.

1-2 QUALITY ASSURANCE: Standards as established by the Underwriter's Laboratory, Inc. (UL), National Electric Manufacturer's Association (NEMA), National Electric Code (NEC), and Manufactured Printed Recommendations, govern the work of this section.

1-3 SUBMITTAL: Submit shop drawings, catalog cuts and manufacturers literature. (See Section 01300).

1-4 RELATED WORK SPECIFIED ELSEWHERE: Valves, Cocks and Faucets, Section 15100; Pipe and Pipe Fittings, Section 15060; Pipe Specials, Section 15080; Meter and Gauges, Section 15170; and Controls, Instrumentation and Alarms, Section 16900.

PART 2: MATERIALS

2-1 MOTOR CONTROL PANEL: The motor control panel shall include all of the features shown on the drawings. The control panel for the high service pumps shall be prewired and factory tested to ensure reliability. The panel shall be in a NEMA 1 enclosure, shall contain a circuit breaker, and an automatic alternator to alternate the lead and a starting sequence of the two pumps, pilot relays, probe-sensor assembly to stop the pumps mounted in a NEMA 3 enclosure, pump start pressure sensors with run lights, air water balance sensor, solenoid valve for air control, hand-off-automatic pump control switches, combination motor-starters for the two high service pumps, and the four alarm annunciators.

The hydro-pneumatic system shall operate as follows: the total capacity of the hydro-pneumatic tank shall be at least 3,000 gallons most of which is filled with air to maintain a pressure in the water distribution system between 60 and 80 psi without the high service pumps in operation; and is sized for a minimum cycle time of the pumps starting to be about four times per hour. The controls and alarms shall be a combination of pressure switches and level switches of level probes. The lead pump shall start at a pressure of abut 60 psi and with a water depth of about 1 foot above the outlet of the pneumatic tank. The pump shall stop when the pressure reaches about 80 psi or with a probe level (as shown on the drawings) pump stop control, whichever occurs first. The solenoid shall provide air to the tank to achieve the pressure of 80 psi if the water level is reached before the pressure is 80 psi. Each pump has the design capacity to meet the peak hour demand; however, in an emergency for additional flow the lag pump would start at a pressure of 50 psi as a back-up to the lead pump. To ensure equal wear and reliability there shall be an automatic alternator to alternate the lead-lag starting sequence of the two pumps. To ensure fail safe operation the shut-off head for the high service pumps shall be less than 100 psi. The piping and pneumatic tank shall be pressure tested at 150 psi. All lines and equipment shall have isolating valves for maintenance. Facilities shall be installed on the pneumatic tank independent of the pressure controls in the panel to limit the maximum pressure in the tank to 85 psi and to keep the air from going out into the distribution system by maintaining a minimum level of 6 inches of water in the pneumatic tank. To keep the high service pumps from breaking suction in the 50,000 gallon storage tanks a level switch shall stop the pumps when the level in the tanks is 6 inches above their outlet. A level switch shall stop the transfer pump when the level in the storage tank is 6 inches from being full.

For the four alarm and fail functions there shall be an annunciator light all of which will sound an alarm horn which has a manually operated silence switch. The pressure controls and alarms shall have independent switches for each function. Each pressure sensor shall be adjustable over a minimum range of plus or minus 10 psi from those pressures shown on the drawings. The pressure sensing bellows shall operate a dustproof glass sealed mercury switch. They shall be restricted in their movement to those pressures at or beyond their set point to prevent fatigue failure and errors due to hysteresis effect. The accuracy shall be plus or minus 1% of full scale. Within the same panel enclosure shall be the combination motor starters with circuit breakers and magnetic across the line starters for each of the ten (10) horsepower motors to operate on 220 volt, three phase, AC power. The loss of a single phase shall cause the pump to stop. The control circuitry power shall be 110 volt, single phase, and for fail safe operation its circuit shall be independent of the pump circuits.

The unit shall be Autocon Duotrol Class 1503 of the Air-Add type, as manufactured by Autocon Industries, Inc., 995 University Avenue, St. Paul, Minnesota 55104, or approved equal.

2-2 The air compressor package shall include horizontal 30 gallon ASME storage tank, with dual compressors with a minimum capacity of 2 CFM @ 100 psig. The units shall have a control panel consisting of a hand-off-automatic switch, an alternator for lead-lag functions. The unit shall be complete with check valves, inlet and outlet gauges, pressure switches with an alarm set at 60 psig. The compressor package shall include an air dryer capable of taking compressed air at 150° F at a flow of 15 scfm at 100 psig and delivering air with a dew point of 35°F. The compressor tank shall have an automatic drain valve. The compressor package shall be Squire-Cogswell Duplex Compressor System Model No. SCPD 2.5 - .75 - DP or approved equal.

2-3 Pressure reducing and sustaining regulator and flow indicator.

A. A air pressure reducing valve shall be furnished which reduces pressure from a high pressure of 45 to 100 psi to an adjustable range from 15 to 25 psig. The pressure regulator shall be adjustable and will maintain the outlet presusre within ± 1/2 psi at flow rates from 0 to .08 cubic feet per hour. The pressure regulator shall have 2 inch high pressure gauge graduated in psi (0 to 150) and a 2-inch low pressure gauge with dual graduation in feet (0-50 ft.) and psi (0-25 psi). The regulator shall be supplied with NPT or adapters.

B. Flow indicator and needle control valve - a plastic body flow indicator for air with 0 to .08 cubic feet per hour flow rate. The flow indicator shall be Brooks - Mite Model 2001-V with needle valve.

2-4 Vane Activated Flow Switch - a magnetically activated flow operated switch shall be provided. The switch shall be Magnetrol Model F-1000 flow switch or approved equal.

PART 3: EXECUTION

3-1 The high service pump control panel shall be wall mounted as shown on the drawings. All wiring from the control panel shall be conduit. All conduits shall be routed to their destination and in an orderly manner so as not to obstruct traffic and have sufficient cover so as not to be damaged by traffic loads.

3-2 All air lines shall be properly supported and be located so as not to obstruct traffic and be properly protected so as not to be damaged by traffic. All air lines shall be sloped to drain to a low point to prevent damage from freezing in the winter time.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing water supply shower drains, domestic water heater, anti-syphon equipment and showers.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Pipe and Pipe Fittings - Section 15060.

1-3 QUALITY ASSURANCE: BOCA Code, ASME, and Manufacturer's printed recommendations, and Underwriters Laboratories (UL).

1-4 SUBMITTALS: Submit shop drawings fully describing drains, water heater, valves and showers required for the project. (See Section 01300.)

Submit test reports on soil piping system and water piping system.

PART 2: MATERIALS

2-1 FLOOR AND SHOWER DRAINS: Coated cast iron, two piece body with double drainage flange, weepholes, bottom outlet inside caulk connection and adjustable satin bronze six inch round top. The drains shall be Josam 3000A or approved equal.

2-2 DOMESTIC WATER HEATER: Electric with a fifteen gallon tank, one two thousand five hundred watt low density elements, for operation at two hundred forty volts, single phase. Recovery ten and two tenths gallons per hour at 100°F temperature rise. Tank to be glass lines with double insulation and front drain valve; unit to be U.S. tested.

2-3 ANTI-SYPHON VALVE: To consist of two separate spring loaded check valves and a differential relief valve. These devices to automatically reduce the pressure between the check valves. Check valve and differential relief valve to be constructed so service can be made without removal of device from the line. Unit to be rated to 175 psi working pressure and water temperature up to 212°F. Size to be two inch.

2-4 SHOWERS: Single head drench type for flush mounting in ceiling with chain through ceiling and pull handle below ceiling. Unit shall be designed for laboratory use with polished chrome plated head, for 1 inch supply with instant action self-closing ball valve. Unit shall be Haws Drinking Faucet Company Model 8169 with 8126 shower head or approved equal.

PART 3: EXECUTION

3-1 FLOOR AND SHOWER DRAINS: Drains to be installed with tops flush with finished floor.

3-2 DOMESTIC WATER HEATER: Install in level position. Water inlet and outlet pipes to each have a union and ball valve installed at six feet above floor. Relief valve outlet to be piped to floor drain.

3-3 ANTI-SIPHON VALVE: Valve to be installed with union connections.

3-4 SHOWERS: Install with head flush with ceiling. Secure to wall with anchors and vandalproof screws.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing the intake screen and accessories, the intake piping, providing and installing of the solids contact tank and accessories, and the rapid sand filters with the transfer pumps.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Pipe and Fittings - Section 15060, Valves, Cocks and Faucets - Section 15100, Intake Protection - Section 02935, Marine Work - Section 02900, Pumps - Section 15140.

1-3 QUALITY ASSURANCE: References - American Society for Testing and Materials (ASTM), American Water Works Association (AWWA) and Manufacturer's printed instructions and recommendations.

PART 2: MATERIALS

2-1 INTAKE SCREEN: The intake screens shall be made of 304 stainless steel. The top and bottom plates shall be 3/16" thick with required reinforcement with the bottom fitted with a 4" ASA 125 flange adapter. The top plate shall contain an eye bolt of 1" diameter made of 5/16" diameter stainless steel rod. The eyebolt shall be welded into place in the center of the top plate to be used for attaching a float and to be used to lower the structure into place. The slotted screen cylinder shall be made of triangular cross section (V shaped) wire and each wire shall be welded at each inside reinforcement. The completed intake screen shall be 18 inches outside diameter and 9 inches high with 0.10" slots being formed by the wire. The screen shall be designed for a flow of 80 gpm with a maximum face velocity of 0.3 ft/sec.

2-2 STAINLESS STEEL SUPPORT CABLE AND FITTINGS: The 5/16" diameter cable for connecting the float to the intake screen and the intake structure to the main anchor shall be made of 18-8 type 304 stainless steel with a 1 x 19 construction with a breaking strength of 12,500 pounds. The cable shall conform to the latest military specifications. All fitting used to connect the cable to the intake screen, float and anchor shall be stainless steel. The completed assembly of wire thimbles and cable clamp shall have a working strength of not less than 3000 pounds.

2-3 INTAKE SCREEN FLOAT: The intake screen float shall have a buoyant force of 300 lbs. when totally submerged at 32°F. The float shall be constructed of polystrene foam covered with a protective cover of Alclad 2024S-T or 2S(1100) of .063 inches thickness. All edges shall be roll locked to add strength to the finished float. A 5/16 inch stainless steel cable (see paragraph 2-2) shall be fastened through the center of the float with loops at top and bottom. A .25 inch thick washer 6 inch outside diameter shall be used on the top and bottom of the float on the cable to act as a bearing plate. The washer shall be of the same alloy as the aluminum cover. The float shall have the nominal dimensions of 1-1/2 feet diameter and 3 feet long.

2-4 SOLID CONTACT TANK AND EQUIPMENT:

A. One 12 foot 0 inch diameter x 15 feet-0 inch side water depth totally covered steel solid contact tank shall be supplied. The tank shall include all baffles, ports, inlet cones, agitators and recirculation, a tank cover splitter box and piping as shown on the drawings. The unit shall include only the 2" drain valves. The unit shall be guaranteed to deliver an effluent of not greater than 10 mg/l of turbidity when operated at 60 gpm.

The incoming water flow and chemicals shall be introduced into the mixing flocculation zone in the center of the tank containing an agitator. Baffles, ports and cones shall be included providing a positive return of thoroughly reacted slurry, to the mixing flocculation zone. The turbulence of the mixing flocculation zone shall not be carried into the clarification zone. The slurry recirculation rate shall be adjustable over a range of 3 to 1 from a maximum of not less than 8 times the design flow rate.

The reacted sludge will be collected, concentrated and automatically withdrawn thus providing for a positive slurry concentration control. Suitable valves and connections are to be included to permit manual draining of the treating basin. Manual sampling valves shall be provided to permit sampling of treating basin contents of 5 significant zones.

There shall be a quiescent clarification zone on the periphery of the mixing-flocculation zone. It shall be sized so that the rise rate at a point 6 feet below normal water level will not exceed 0.62 gpm per square foot of clarification zone area at the normal operating flow rate of 60 gpm.

Total detention time in the treating basin shall be not less than 211 minutes at the normal operating flow rate of 60 gpm. The solids contact tank shall be General Filter Company Contraflo Type CTH or approved equal.

B. Equipment Design: The steel plates and shapes used in fabricating the basin equipment shall be sized in accordance with the acceptable structural design practice. Minimum steel thickness shall be not less than 3/16". The unit shall be delivered in the fewest practicable number of pieces.

C. Walkways and Railing: A walkway bridge of structural steel shall be provided to extend across the basin and designed to support all moving parts, center cone and recirculating propeller drive mechanism. It shall be not less than 36" wide, equipped with 1/4" checkered floor plate. A 1-1/2" pipe handrailing shall extend along both sides of the walkway.

D. Cone: The clarification zone shall be separated from the mixing-flocculating zone by a properly supported steel cone. It shall have a minimum slope of 50° from the horizontal and a volume which will provide adequate time for proper flocculation.

E. Agitator and Drive: Agitator shall be a balanced cast iron propeller suitable for the liquid being treated. The propeller shall be pinned to a solid shaft connected to a worm gear reducer. There shall be provided a drive motor of suitable size together with variable speed control having a speed range of 3 to 1. The mixer shaft shall be equipped with sealed anti-friction bearings located above high water level. Underwater bearings will not be accepted. One spare agitator and drive shall be supplied with this equipment. Agitators shall be equipped with a hand-off automatic switch located at the agitator.

F. Effluent Launder: A perimeter effluent launder with orifice type collectors shall be provided.

G. Cover: A top cover shall be provided which shall close the tank from entry of any manual or man made contaminants. The cover shall include seals at any equipment opening. The materials and design of the covers and scales shall be such that the covers are water tight and not subject to deterioration from natural elements including weather, sunlight, insects and gnawing animals. The cover shall be hinged with a waterproof hinge. The cover shall include a hardened hasp and lock for each half of the tank cover. When the cover is open it should be possible for the operator to look into the tank to observe the operation of the equipment. The cover shall be capable of supporting a snow load and 300 pounds of concentrated load with a deflection not to exceed 1/360 of span length.

H. Painting: The equipment shall be cleaned of loose mill scale and grease and given one shop coat of red oxide primer before shipment. Finish painting shall be provided under Section 09901 - Painting and Other Finishes.

2-5 GRAVITY SAND FILTERS:

A. General: There shall be furnished two cylindrical steel gravity multi-media gravity filters with a capacity of 60 gallons per minute at a loading rate of 3 gallons per minute per square foot. The filter shall be fabricated from 1/4" mild steel plate having a tensile strength of 55,000 pounds per square inch or greater. The filters shall be General Filter Model 24 or approved equal.

B. Underdrain Distributor: The filter bottom shall be equipped with an underdrain system of the collector chamber design, consisting of a rigidly supported plate extending over the entire bottom of the filter area. It shall be perforated with openings on approximately 14" centers throughout. The openings shall be controlled with non-clogging stainless steel baffle plate underdrains secured to the supporting floor. The design of the baffle plate shall be of a two shroud welded together type. The stainless steel lower shroud shall have a stainless steel eye extending through the support floor and a stainless steel orifice located below the bottom surface of the supporting plate to eliminate tuberculation around the orifice. The underdrains shall be so designed as to reduce the water velocity, discharging the water horizontally without impeding its flow, thereby preventing channeling of the bed. The total orifice area shall be not more than 0.3% of the total bed area.

Each filter shall be provided with suitable means for distributing raw water and for collecting wash water over the entire area of the filter.

C. Supporting Beds: Each filter shall be provided with a graded gravel supporting bed consisting of properly graded layers of gravel.

The gravel bed shall be as follows:

Layer & Depth	Passing Screen	Retained on Screen
Bottom 4"	1-1/2"	3/4"
Next 4"	3/4"	1/2"
Next 4"	1/2"	1/4"
Top 4"	1/4"	#10

The gravel shall be free from clay, loam, dirt, calcareous, or other foreign material, and shall consist of round or angular particles being relatively free of elongated particles.

The gravel shall be shipped bagged.

D. Filter Media Multi Media: The filter bed shall consist of 11 inches of filter sand having an effective size 0.5 to 0.6 mm., and a uniformity coefficient of not more than 1.6.

The sand shall be shipped bagged.

The surface of the filter bed shall consist of No. 1 size anthracite having a bed depth of 19 inches. The anthracite shall have an effective size of 0.60 to 0.80 mm., and a uniformity coefficient of 1.75.

The anthracite shall be shipped bagged.

E. Filter Wash Trough: Each filter shall be provided with a steel wash trough designed for proper collection of backwash water at a backwash flow rate of 430 gpm.

The wash trough shall be constructed of 3/16" steel with the upper edges fitted with 2" x 2" x 3/16" angles. The upper edges shall be uniform and level to provide for uniform collection of the wash water.

F. Pipe Sizes: The filter unit piping shall be sized as shown on the drawings.

All valves necessary for the operation of the equipment shall be provided. The manufacturer is to provide standard interconnecting piping between the filter units. All valves 2-1/2" or larger shall be iron body, bronze mounted, non-rising stem gate valves for 125 lbs. per square inch working pressure. Valves 2" and under shall be brass. All gate valves shall conform to AWWA standards.

All piping shall be standard weight galvanized wrought steel. Welded and flanged connections shall be used on pipe 3" or larger in diameter. Threads will not be acceptable on pipe 3" or larger in diameter.

G. Rotary Surface Washers: Provide one 5 ft.-0 inch over all length rotary surface washers per filter with support brackets, piping within limits of filter basin and 1 electrically operated valve packs operated from control console. The flow shall be not less than 29 gpm @ 50 psi.

H. Filter Accessories: Furnish one mercury manometer indicating loss of head gauge calibrated in feet for each filter.

Furnish a flat operated monoflange tight shutoff butterfly valve on each filter effluent for modulating low level shutoff as specified in Section 15100 - Valve, Cocks and Faucets.

I. Painting: The filter tank exterior shall be properly cleaned and one shop coat of red lead primer applied before shipment. The filter tank interior above underdrain shall be properly cleaned and one coat of primer and two coats of Inertol #49 applied before shipment. A finish coat shall be provided as specified in Painting and Other Finishes - Section 09901.

J. Transfer Pumps: Two transfer pumps shall be provided as specified in Pumps - Section 15140.

PART 3: EXECUTION

3-1 Intake screen and piping shall be assembled and tested for fit prior to shipping to job sight. Assembly and installation shall be as specified in Marin Work Intake - Section 02900.

3-2 Solids contact tank shall be installed as shown on the drawings and in accordance with the manufacturer's written installation instructions. The completed installation shall be inspected by a qualified representative of the manufacturer before start-up.

3-3 Rapid sand filters shall be installed as shown on the drawings and in accordance with the manufacturer's written installation instructions. The completed installation shall be inspected by a qualified representative of the manufacturer before start-up.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section includes furnishing, setting and connecting all plumbing fixtures. Exposed metal parts to be chromium plated. Fixtures to bear manufacturer's guarantee label or trademark indicating first quality. Each fixture to have individual shut-off valves.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Pipe and Pipe Fitting, Section 15060; and Valves, Cocks and Faucets, Section 15100.

1-3 QUALITY ASSURANCE: BOCA Code, Manufacturer's printed recommendations.

1-4 SUBMITTALS: Submit shop drawings fully describing all fixtures, valves, trim and carriers required for the project. (See Section 01300.)

PART 2: MATERIALS

2-1 WATER CLOSETS: Vitreous china wall mounted with blowout action, elongated bowl with one and one-half inch back spud. Provide white solid plastic open front seat with stainless steel, self sustaining check hinge. The unit shall be American Standard elongated water-saver cadet or approved equal.

2-2 TOILET TANK SUPPLY: 3/8 inch with 3/8 inch angle valve and handle, inlet 3/8 inch male thread escutcheon and 3/8 inch flexible tube riser chrome finish.

2-3 LAVATORY: Provide 20 x 18 white vitreous china fixtures with faucet holes on four inch centers, soap depression and front overflow. Lavatory to be American Standard Scotian or approved equal. Provide lavatory carrier with concealed arms Josam Series 17110-8" or approved equal.

2-4 LAVATORY TRIM:

A. Provide chrome plated center-set faucet with renewable seats with crown handles and spray end. Trap to be adjustable, chrome plated brass adjustable "P" type with swivel ell, 1-1.4 inch inlet, 1-1/4 inch outlet, ground swivel joint and cleanout plug. Trim to be American Standard Heritage No. 2103.448, or approved equal.

B. Provide perforated grid lavatory drain with 1-1.4 inch tailpiece and two one-half G.P.M., three-eights flow controls.

C. Provide three-eights IPS chrome plated flexible supplies with screw driver stops.

PART 3: EXECUTION

A. Water closets to be mounted as shown on the drawings. Caulk fixtures at floor with white silicone caulking compound.

B. Lavatories to be mounted as shown on the drawings. Installation to include all trim and accessories.

C. All fixtures to be set level and square with relation to interior finished floors and wall lines. Each fixture shall be provided with individual shut-off valves. During construction, cover exposed fittings and protect all fixtures.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of supplying and installing the chemical mixing tanks, mixers, and chemical feed pumps, and a years supply of chemicals.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Pipe and Pipe Fittings - Section 15060; Pipe Specialties - Section 15080; Valves, Cocks and Faucets - Section 15100; Plumbing - Section 15400; Electrical Division 16.

1-3 QUALITY ASSURANCES: References - The manufacturer's written instructions.

PART 2: MATERIALS

2-1 INLINE STATIC MIXER:

A. The inline static mixer shall be capable of providing sufficient turbulence to provide complete mixing of the coagulant, coagulant and chlorine into the raw water before entering the solids contact tank.

B. The static mixer shall be made up of a series of three bladed segments. The segments shall be interlocked but the relationship can be varied in 12° increments. The segments shall be made of Type 316L stainless steel.

C. There shall be segments with left handed rotation blades and segments with right handed rotation blades. The combinations of left and right handed segments shall provide the mixing required. The unit shall fit into standard 4 inch ductile iron pipe. The units shall be Lightning Series 50, In-line Blender Laminar Module, or approved equal.

2-2 CHEMICAL FEED SYSTEM:

A. Chemical Storage Tanks: The storage tanks shall be polyethelene tanks with fiberglass covers. The tanks and covers shall have openings to accommodate the equipment and connections as shown on the drawings. There shall be one 105 gallon tank and four 55 gallon tanks. The tanks shall be self supporting and mounted on stands as shown in the drawings. The tanks shall be translucient and shall have gradations every 5 gallons.

B. Chemical Mixer: Each tank shall be equipped with 1/4 horsepower, totally enclosed and fan cooled mixer with 316 stainless steel shaft and impeller. The mixer for the 105 gallon tank and three of the 55 gallon tanks shall operate at 1725 rpm and the mixer for one of the 55 gallon tank (coagulant aid tank) will operate at 350 rpm. The mixers shall be equipped with a waterproof hand-off-automatic switch at the mixer. The mixers shall be mounted to the tank stands and not the tanks.

C. Chemical Feed Pumps:

1. There shall be four chemical feed pumps with 65 gallon per day capacity and one 20 gallon per day capacity. The pumps and motors shall have ABS plastic housing. The pump shall be a diaphram type pump with nylon-reinforced hypalon diaphram and other wetted parts of hypalon, viton, kynar, elgiloy, PVC and FEP. The diaphram shall have a stroke length of 3/16 inch. The pumps shall be adjustable over a 10 to 1 range with a maximum discharge pressure of 100 psi. The motors shall be 115 volt 60 Hz, single phase with Class B insulation and thermal protections. All pumps shall have U.L. label. The pumps shall be equipped with a waterproof hand-off-automatic switch at each individual pump. Pumps shall be Wallace and Tiernan 94 Series Solution Metering Pumps or approved equal.

2. There shall be one diaphram metering pump for use with pH adjustment with a capacity of 175 gallons per day. The pump shall be a single head type with a nylon-reinforced hypalon diaphram constructed for low stroking speeds and short stroke length. The pump shall be belt driven with 4-step pullies for speed adjustment. Manual stroke length adjustment shall be provided which will give a flow range adjustment of 10:1. The pump head shall be constructed of ABS (Kralastic) a clear plastic cover plate shall be provided for observation of proper pump operation. The valve seats shall be independent of the valve body. The pump shall be capable of 125 psig operating pressure. The drive mechanism shall be a cast aluminum housing with oil dipstick and a fiberglass base. The motor shall be NEMA design of 1/4 horsepower totally enclosed fan cooled 115 volt, 60 Hz., single phase 1725 rpm. The pump shall be equipped with a waterproof hand-off-automatic switch at the pump. The pump unit shall be Wallace and Tiernan, solution metering pump diaphram Type Model 44-747 single head, or approved equal.

CHEMICALS

Application	Chemical Used	Form	Container or Bag Size	Number Required	Commercial Strength
Chlorination	Calcium Hypo-Chlorite, $Ca(OCl)_2$ $4H_2O$	Granular	100 lb. Cans or Bags	2	70% Available Cl_2
pH Adjustment	Sodium Carbonate, $NA_2\ CO_3$ (Soda Ash)	Granular	100 lb. Bags	10	99.2% Na_2CO_3
Coagulation	Aluminum Sulfate, $Al_2(SO_4)_3-14H_2O$ (alum)	Rice	100 lb. Bags	3	98%+
Coagulant and/ or Filter Aid	Nonionic Polyelectrolyte	Liquid or Dry Powder	Sample*	2 lbs.	98%+

*Sample - Normal purchase of small quantities of polymer usually not possible therefore NPS should request samples of the polymers required. A sample of 2 pounds would be sufficient for one season. It is not recommended that larger quantities than 3 pounds be obtained as the products generally have a shelf life of 6 months to one year after which their performance can not be guaranteed. One polymer which is recommended is Dow Chemical Corporation - Experimental Polymer XB 7817.00P - member of the Purifloc Family. An alternate is Cyanimide 985-N available from American Cyanamid.

D. Chemicals: A years supply as defined below shall be supplied as part of this section.

PART 3: EXECUTION

3-1 The inline static mixer shall be installed in the raw water influent line as shown on the drawings as in accordance with manufacturer's instructions. After initial operation the blade segments shall be adjusted to achieve complete mixing. Complete mixing shall be defined by effective operation of the solids contact tank at design flows.

3-2 Chemical feed system including pumps, tanks, mixers, piping shall be installed as shown on the drawings and in conformity to the manufacturer's written instructions.

3-3 CHEMICALS: The years supply of chemicals shall be stored in the areas provided in a manner which will protect them for future usage.

END

PART 1: GENERAL:

1-1 DESCRIPTION: The work under this Section consists of providing a portable fire extinguishers

1-2 QUALITY ASSURANCE: Underwriters' Laboratories (UL), National Fire Protection Association (NFPA).

1-3 SUBMITTALS: Submit Shop Drawings.

PART 2: MATERIALS

EXTINGUISHER - Five pound A.B.C. bracker mounted.

PART 3: EXECUTION

Secure bracket to wall where noted on drawings (F.E.).

END

PART 1: GENERAL

1-1 DESCRIPTION: The work under this section consists of providing an in-line exhaust fan.

1-2 QUALITY ASSURANCE: Air moving and Conditioning Association (AMCA).

1-3 SUBMITTALS: Submit Shop Drawings. (See Section 01300.)

PART 2: MATERIALS

2-1 EXHAUST FAN - Centrifugal-in-linedirect driven fan with aluminum straight sided housing and companion angle rings for connection to duct work. Fan shall incorporate integral straightening vanes. Provide 100% gasketed panel for motor access. Motor to be encased in spun housing. All moving parts to be provided with vibration isolation. Fan wheels to be backwardly inclined, non-overloading, blades of aluminum. Provide internal terminal box mounted on exterior. Capacity 1285 CFM at 0.25 inches S.P. 1/4 H.P., 115 volts, 60 cycles, 1 phase.

PART 3: EXECUTION

Install fan where shown on drawings using vibration hangers. Ductwork to be connected using flexible glass fiber cloth connections.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work under this section consists of providing galvanized sheet metal ductwork for an exhaust system.

1-2 QUALITY ASSURANCE: Sheet Metal and Air Conditioning Contractors' National Association. (SMACNA).

1-3 SUBMITTALS: Shop Drawings of duct system layout, exhaust grilles and wall louvers. (See Section 01300.)

PART 2: MATERIALS

2-1 SHEET METAL; Prime quality galvanized steel.

2-2 METAL GAUGES: U.S. Standard Gauge No. 26 on duct sizes through 12 inches and No. 24 gauge on duct sizes 13 inches through 30 inches.

2-3 DUCT HANGERS: Bank iron straps per SMACNA recommendations.

2-4 MANUAL DAMPERS: Single blade with indicating device with lock.

2-5 TURNING VANES: For square elbows, are to be in accordance with SMACNA recommendations.

2-6 INLET LOUVERS: Anodized aluminum with removable core and 1 inch wide frame.

2-7 WALL LOUVERS: Anodized aluminum with baked enamel finish, color to be selected.

PART 3: EXECUTION

3-1 ELBOWS:

A. Standard radius elbows shall be used wherever possible with radius of throat equal to the width of the elbow.

B. Stort radius elbows shall have a vane spaced according to SMACNA recommendations; vane shall be riveted or spot welded to duct sides.

3-2 TAPERS AND OFFSETS:
A. When a taper is used in a "diverging" air flow and duct size increased, the sides are to be pitched to a maximum of 60°.

B. When a paper is used in a "contracting" air flow and the duct size is decreasing, the sides shall be pitched to a maximum of 60°.

3-3 BRANCHES:
A. Branches shall be constuucted in three parts in accordance with SMACNA recommendations.

B. Branch tees shall be tapped in a taper in the main duct.

3-4 REGISTER AND GRILLE CONNECTIONS: Provide all wood grounds or frames required for exhaust grilles. All grille connections shall have provisions for volume control if same is not furnished with grille.

3-5 VOLUME DAMPERS: Volume dampers shall be installed in all branches or at all exhaust openings where shown on the drawings, or necessary for proper balancing of air distribution.

3-6 SEAMS AND REINFORCING:
A. Longitudinal seams shall be Pittsburgh Lock or Acme Lock.

B. Reinforcing angles and bars shall be galvanized and riveted, bolted or welded securely to the duct sheet to prevent vibration. Reinforcing shall be in accordance with SMACNA recommendations.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section consists of general provisions pertaining to all electrical work. Electrical work includes furnishing and installing all the electrical power, lighting, heating, ventilating, instrumentation and controls systems and all associated work as specified below.

1-2 SCOPE:

A. The work covered by this section of the Specifications consists of furnishing all labor, equipment, supplies, and materials, and of performing all operations necessary for the installation of complete interior and exterior wiring systems, raceways, electrical equipment, electrical connections to all equipment, including connection of equipment furnished by others, in strict accordance with this item of the Specifications and the applicable drawings.

B. It is the intention of this Specification to broadly outline the equipment required, **but not to cover the details of design or construction.**

1-3 CODES AND STANDARDS:

A. The installation shall conform to the latest applicable rules of the National Electrical Code, National Fire Protection Association and shall comply with all State and Local Laws and Ordinances.

B. All materials shall conform with the Standards of the Underwriters Laboratories in every case where such standards have been established for the particular type of material in question and shall be labeled to be acceptable.

C. Codes shall be used as minimum requirements, and where the Specifications or Plans call for an installation that exceeds and does not violate the code requirements, the Specifications and Plans shall be followed.

1-4 QUALITY OF WORK: The installation shall present a neat mechanical appearance when completed.

1-5 O.S.H.A. REQUIREMENTS: The complete electrical installation shall comply with all the requirements of the Occupational Safety and Health Administration (O.S.H.A.).

1-6 COORDINATION WITH OTHER TRADES: The Contractor shall consult the Plans and Specifications of other trades to insure that any possible overlap between trades is understood, and any conflicts between structures or equipment shall be corrected prior to installation.

1-7 **SUBMITTALS:** The Contractor shall submit, in accordance with Section 01300, shop drawings of all major items of equipment being furnished for the project.

PART 2: MATERIALS

No materials required for this section.

PART 3: EXECUTION

3-1 LAYOUT OF WORK: All lighting-fixture locations shall be located by the Contractor and approved by the Contracting Officer prior to installation.

3-2 The Contractor shall provide as-built drawings as specified in Section 01700 - Project Close Out.

3-3 GUARANTEE: The Contractor shall provide a written guarantee stating that all work performed and materials furnished are free from all defects in workmanship, design of material for a period of one (1) year after the date of final acceptance by the Government, and in the event that any part of the work or equipment fails (abuse and causes beyond control of the Contractor excepted), within this period of guarantee, it shall be replaced by the Contractor at no cost to the Government.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section consists of describing the basic materials and methods to be used in all electrical work.

1-2 QUALITY ASSURANCE: Reference, National Electrical Code (NEC), National Fire Protection Association (NFPA).

1-3 SUBMITTALS: Submit Shop Drawings (See Section 01300).

PART 2: MATERIALS

2-1 GENERAL:

A. All wiring shall be installed in rigid conduit, intermediate metal conduit (IMC), flexible conduit, electrical metallic tubing (E.M.T.), or other approved raceway.

B. The conduit system and neutral conductor of the wiring system shall be grounded. For continuity of ground, all outlets shall be bonded to the main conduit run, jumpers provided at all expansion joints, and the frames of all motors and electrically operated equipment securely bonded to the main conduit system. The ground connection shall be made at the service entrance equipment and shall be extended and connected to the main water service and/or the well casing. For the fuel system provide grounding wire in conduits run outside or underground in hazardous areas.

2-2 OUTLET BOXES:

Each outlet in the wiring or raceway systems shall be provided with an outlet box to suit the conditions encountered. Boxes installed where exposed to the weather or in normally wet locations and in Class I, II and III hazardous locations shall be of the cast-metal type having threaded hubs. Boxes in other areas shall be of the cadmium-plated or zinc-coated sheet-metal type. Each box shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of the National Electrical Code. Boxes shall be not less than 1-1/4 inches deep unless more shallow boxes are required by structural conditions. Ceiling and bracket outlet boxes shall not be less than 4 inch octagonal except that smaller boxes may be used where required by the particular fixture to be intalled. Flush or recessed fixtures shall be provided with separate junction boxes when required by the fixture terminal temperature requirements. Switch and receptacle boxes shall be approximately 4 inches by 2 inches, and shall have a rated wiring volume of not less than 14 cubic inches.

B. Pull boxes shall be constructed of code-gauge galvanized sheet metal of not less than the minimum size required by the National Electrical Code. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

C. Conduits stubbed up through concrete floors for connections to free-standing equipment shall be provided with a short elbow and an adjustable brass top or coupling of brass or bronze set flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible sealtite conduit may be used about 6 inches above the floor.

2-3 DEVICE PLATES: Of the one-piece type shall be provided for all outlets to suit the devices installed. Plates on unfinished walls or on fittings shall be of zinc-coated sheet-metal having rounded or beveled edges. Screws shall be of metal with countersunk heads, with color to match the finish of the plate. Plates shall be installed vertically and with an alignment tolerance of 1/16 inch. The use of sectional-type device plates shall not be permitted.

2-4 BRANCH LIGHTING PANELS: The Contractor shall furnish and install surface or flush mounting branch lighting panels where noted and shown on the drawing. Panels shall be dead front construction, enclosed in code gauge galvanized steel box with hinged steel door, latch, and lock.

Panels shall be equipped with 125 volt, 20 ampere, 1, 2, or 3 pole thermal magnetic quicklag de-ion, plug-in type, interchangeable circuit breakers, as indicated on the drawing or required by Code. Two and three pole breakers shall be common trip. Plug-in circuit breakers shall have a minimum interrupting capacity of 10,000 amperes symmetrical.

Panel fronts shall be equipped with concealed hinges and semi-flush catch, lock and key.

Panels in finished areas shall be furnished with prime coat of paint and shall be painted by the Contractor to match adjacent area. Panels in unfinished areas shall be furnished with standard factory finish. Upon completion of job, Contractor shall touch up, using paint supplied by the factory, all spots where factory finish has been marred.

Panels shall be 120/240 volt, 3 phase, 4 wire, solid neutral, with main lug rating as shown on the drawing, such as I.T.E., NPAB, Westinghouse NPLAB, General Electric NTLQ, or approved equal.

2-5 MOTORS:

A. Motors 1/3 HP and smaller shall be 120 volts, single phase. Motors 1/2 HP and larger shall be 240 volt, 3 phase. Motors shall be size and rating as indicated on the drawing. Motors that are an integral part of special equipment may vary from above to meet manufacturing standards.

B. Motors to be used in hazardous areas, Division: Class I or Class II shall be approved for that service.

2-6 MOTOR STARTERS:

A. General: All motor starters and push button stations shall be provided with an engraved, laminated plastic nameplate.

Starters shall be furnished by the Contractor for all equipment except where the starter is built into the equipment, or other special applications.

B. Starters shall be furnished with the following components:

120 volt control transformer, fused.

Red and green pilot lights in cover, red light indicating running conditions.

Holding coil rated 120 volts.

Hand-off-auto selector switch in cover for motors requiring automatic control.

Start-stop buttons in cover for motors requiring push button stations.

Phase failure, phase reversal, low voltage relay (Tim Mark Corp., or approved equal), 3 phase starters, plug-in type for ease in replacement, wire into control circuit.

Overload protection and number of auxiliary contacts needed for each application.

C. Fusetrons sized for motor protection shall be furnished for all combination starters. (Not greater than 125% of motor nameplate rating.)

D. Starters shall be minimum Size No. 0 and shall be as manufactured by General Electric, Westinghouse, Allen Bradley, Cutler Hammer, Square-D, Furnas or approved equal.

E. Manual Starters: Manual starters shall be provided for all single phase, fractional HP motors. Starters shall be Square-D Class 2510, General Electric, Furnas Class II or approved equal, single or double pole as required, with pilot light, thermal overload protection and general purpose enclosure, unless otherwise noted on the drawing.

2-7 DISCONNECT SWITCHES: Disconnect switches shall be furnished and installed where indicated on drawing, size as required. Switches shall be fused or nonfused as noted, 600 volt, Class A, heavy duty, NEMA I General Purpose NEMA 3 R rain-tight enclosures as noted, or required with quick make, quick break operating mechanism, cover interlock, and provisions for padlocking Square-D Type HD, GE, ITE or Westinghouse or approved equal.

2-8 FUSES: The Contractor shall furnish a complete set of fuses for all switches and panels, and shall at the completion of the job, replace all blown fuses. Fuses installed in service entrance switch shall be Buss Lo-Peak current limiting non-renewable type. Fuses installed in remaining circuits shall be NEC non-renewable, dual-element type, Buss Fusetrons.

PART 3: EXECUTION

3-1 OPENING FOR CONDUIT AND ELECTRICAL APPURTENANCES:

A. The Contractor will provide all required openings in walls, ceilings, and floor construction for the electrical installation.

B. The Contractor shall be responsible for the accurate location of all openings to be made for the installation of the electrical work.

C. Any additional openings required to move a conduit, outlet box, panel, etc., because of an error in the initial layout, shall be done at no additional cost to the Government.

3-3 MOTOR, STARTERS, DISCONNECTS AND FUSES: The Contractor shall install the equipment and it shall be wired as per Codes.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this Section consists of providing electrical conduits.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavation - Section 02221.

1-3 QUALITY ASSURANCE: All rigid galvanized conduit, EMT, plastic conduit, and lightweight metallic conduits must comply with the standards of ASA, ASTM, UL, NEMA and any other applicable standards.

PART 2: MATERIALS

2-1 GENERAL:

A. Rigid PVC conduit shall be installed in poured concrete slabs, walls, and partitions, and shall also be installed in damp locations and inaccessible places.

B. All conduit 2-1/2 inches and larger shall be rigid steel or pvc

C. E.M.T. may only be installed exposed above suspended ceilings, or in partitions.

D. No E.M.T. or aluminum conduit shall be used in concrete or direct burial, nor in water softener areas or similar corrosive locations.

E. All rigid conduit and E.M.T. shall be hot dipped, galvanized, shepardized, metalized, or electro-galvanized.

F. Rigid conduit shall be installed in all exposed outdoor locations.

G. Flexible Sealite may be used for short runs to individual pieces of equipment.

H. Schedule 40 rigid plastic conduit may be installed where indicated on drawings, and shall be installed in accordance with Art. 347 of the NEC.

I. Flexible steel conduits may be used where construction makes rigid conduit or EMT difficult to install, but such runs shall be kept as short as possible.

J. All final connections to motors must be flexible metal conduit.

K. Liquid tight flexible metallic tubing must be used in all wet or damp locations.

L. All electrical work, except portable cord connections, must be in enclosed raceway.

2-2 CONDUIT SIZE:

A. Size of conduit shall comply with the National Electrical Code. Where conduits are indicated on the drawing to be larger than required by code, the larger conduit shall be used.

B. Where conduit is buried underground outside of building walls, to signs, exterior lights, etc., it shall be not less than 1 inch regardless of wire size.

2-3 CONDUIT:

A. All conduit shall be installed concealed where practicable.

B. In general, no conduit larger than 1 inch shall be installed in concrete slab. Spacing between conduits in concrete slab shall be 8 inches minimum. At panel locations, conduit shall be separated as much as possible.

C. When metal conduit extends below the bottom of a slab on the ground, the slab shall be thickened in the area of the conduit so as to encase the conduit in concrete by at least 2 inches on all sides. The responsibility for and expense of this work shall be borne by the Contractor.

D. All conduit run exposed shall be run parallel to the structural members of the building in a neat manner, securely fastened in place. Approved Condulet type fittings or outlet boxes shall be used at all bends in a vertical plane or where breaking around beams or columns. Bends on ceilings in a horizontal plane shall be made with long sweep ells.

E. All conduit shall be supported by approved hangers.

F. Conduit shall be terminated with locknuts and bushings in all outlet boxes sand panels. Insulated bushings shall be used on all rigid metal conduit 1 inch and larger. Use insulated bushings and connectors on all E.M.T.

G. Conduit located in Class I areas shall be installed according to National Electric Code, National Fire Protection Association and any State or Local codes which apply.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing wire and cable.

PART 2: MATERIALS

2-1 CONDUCTORS:

A. All feeders shall be type THW or RHW copper, sized as required by NEC.

B. In general, all branch circuit wiring shall be 600 volt, copper Type THHN, minimum wire size No. 12 stranded, except where noted otherwise. Branch circuits 100 feet or longer shall be minimum size No. 10 wire.

C. 120 volt control circuits shall be a minimum No. 14 wire.

D. Direct burial cable shall be Type USE or UF.

E. Aluminum conductors shall not be used.

2-2 WIRES: All wires #10 AWG and smaller shall be solid.

2-3 CABLES: All cables #8 and larger shall be stranded.

2-4 INSULATION: Wire and cable insulation shall be as noted and all feeder insulation must be rated for 75°C ambient temperature service.

2-5 WIRE CONNECTIONS AND DEVICES:

A. Taps and splices in all feeder and branch circuit conductors larger than No. 8 shall be made with approved solderless, pressure type bolted connectors. Splices in conductors No. 8 and smaller may be made with pre-insulated Scotch-lock or Ideal wing-nut spring tension connectors, or equal.

B. Taps and splices in direct burial cable shall be in an approved junction box with approved systems for direct burial cables.

2-6 COLOR IDENTIFICATION

A. Neutrals must have white insulation or be painted white where exposed at panelboards or other terminations.

B. Grounding conductors shall similarly be green.

PART 3: EXECUTION

INSTALLATION: Install wire and cable as required for the proper execution of the work shown on the electrical plan.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing lighting panelboards.

1-2 APPROVED MANUFACTURERS: Panelboards shall be as manufactured by General Electric, I.T.E., Square D, or approved equal.

1-3 SUBMITTALS: Submit panelboard shop drawings.

PART 2: MATERIALS

2-1 DESCRIPTION: Lighting panelboard shall be specification grade circuit breaker type, mains rating, main breaker and branch circuit breakers shall be furnished in the quantities, ampere ratings, number of poles and interrupting ratings shown.

2-2 PANELBOARD CONSTRUCTION:

A. Distribution panels and motor starters shall be complete in two panel assemblies furnished and installed by the Contractor. For details on fusible main and circuit branch disconnects, starters, and other appurtenances see the drawings. Panelboards shall meet Federal Specification W-P-115A.

B. Panelboard shall be dead front construction with code gauge galvanized steel box, and top, bottom and side gutter space equal to or in excess of code requirements. Panel front shall be for surface installation with gray baked enamel finish.

C. Panels shall be of voltage and main lug rating as shown on the drawing.

D. Buss bars shall be figured on the basis of 1000 amperes per square inch of cross sectional area for copper, and 500 amperes per square inch for lugs and connections.

E. Panels shall be equipped with neutral bars.

F. Each circuit shall be provided with an engraved laminated plastic nameplate indicating the circuit controlled.

G. Motor starter units shall be pre-wired between load side of disconnect switch and line side of starter. Each starter unit shall be non-reversing, single or variable speed type as shown, NEMA size as required and shall be complete with mechanical interlock between disconnect and starter door, start-stop push button or hand-off-auto selector switch as noted on the drawings, red motor running pilot light, individual control circuit transformer with fused control circuit and auxiliary contacts as required. Each starter shall be equipped with three thermal overload relays of the bimetallic type, sized to protect each motor at no more than 125% of rating.

H. Bus work shall be extended into the circuit breaker "spaces" called for so that additional circuit breakers may be easily installed in the future.

I. Circuit breakers shall be secured to the bus work by means of a bolted connection.

J. Trim shall be surface. Front shall have locking hinged door.

K. Panelboard shall bear the UL label.

2-3 PANELBOARD L - A DATA: 100 amps, 120/240 volts, 1ø, 3 wire with 100 amp 2 pole main circuit breaker. Provide and install the branch circuit breakers as shown.

PART 3: EXECUTION

3-1 INSTALLATION: Secure the panelboard to the concrete block wall with toggle bolts as required.

3-2 PANELBOARD DIRECTORY: Provide an accurate, typewritten directory for branch circuits in L - A after this work has been completed.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing switches and receptacles.

1-2 APPROVED MANUFACTURERS: Specification grade switches and receptacles as manufactured by General Electric, Hubbell, and Sierra are acceptable. Other manufacturers may be submitted for consideration.

PART 2: MATERIALS

2-1 SWITCHES: Light switches shall be flush toggle switches rated for 15 ampere tungsten loads at 125 volts.

A. Single pole and two pole switches are required.

B. Toggles shall be ivory.

C. Switches, unless otherwise noted, shall be mounted 54 inches to center above finished floor.

2-2 RECEPTACLES: General convenience outlets shall be equipped with duplex, 3 wire, grounding type, 15 ampere, 125 volt, specification grade receptacles, color - brown, such as Hubbell No. 5242, Bryant, or P. and S., or equal.

A. Receptacle outlets, unless otherwise noted, shall be mounted 16 inches to center above finished floor.

B. Finish shall be ivory.

2-3 SWITCH AND RECEPTACLE PLATES: All switch and receptacle plates shall be stainless steel with satin finish.

PART 3: EXECUTION

INSTALLATION: Install switches and receptacles where indicated on the electrical plan.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing lighting fixtures.

1-2 APPROVED MANUFACTURER: Lighting fixtures shall be as specified below or approved equal.

1-3 PRODUCT HANDLING: Exercise care during delivery of lighting fixtures to prevent breakage or damage. Damaged or defective fixtures will be rejected.

1-4 SUBMITTALS: Submit lighting fixture shop drawings.

PART 2: MATERIALS

2-1 LIGHTING FIXTURE SCHEDULE:

A. Type A: Kenall Cat. No. 7140 gasketed, surface mounted fluorescent unit with vandalproof Herculex wrap-around lens bracket mounted over mirror in toilet. Install 1-F40CW lamp in fixture.

B. Type B: Kenall Cat. No. 7240 gasketed, surface mounted fluorescent unit with vandalproof opalescent Herculex wrap-around diffuser, with white baked enamel back plate and stainless steel tamperproof captive screws. Install 2-F40CW lamps in fixture.

C. Type C: Keyless 4" porcelain lampholder with 1-100A19 bulb.

D. Type D: Kenall Cat. No. 5808 gasketed, surface mercury vapor unit with Herculex diffuser, matte black steel housing and stainless steel tamperproof captive screws. Install 1-H43AV-75DX lamp in fixture.

E. Type E: Miller Cat. No. KD-2100-04 with 2-F40T12 rapid start lamps - CW. Surface mount on wood framing members.

F. Type F: Miller Cat. No. GT-4192-B4 with 4-F40T12 rapid start lamps - C.W. Recess in suspended acoustical tile ceiling.

G. Type G: Miller Cat. No. PC-2121-02 with 2-20W lamps. Mount over flush outlet box center over mirror.

H. Type H: Acme-Dunbar 201 with 100 watt incandescent lamp mount over flush outlet box with bottom of fixture 7'-6" above finished floor.

2-2 BALLASTS: Ballasts shall be ETL approved high power factor "P" rated units.

PART 3: EXECUTION

3-1 INSTALLATION: Install lighting fixtures where indicated on the electrical plan. Fixtures shall be square with the building.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing electric unit heaters with thermostatic controls.

1-2 RELATED WORK SPECIFIED ELSEWHERE: General Electrical Provisions - Section 16010; Wire and Cable - Section 16120.

1-3 QUALITY ASSURANCE: BOCA Code, Underwriters Laboratories (UL), National Electric Manufacturers Association (NEMA) and OSHA.

PART 2: MATERIALS

2-1 BASEBOARD HEATERS: Baseboard wall heaters shall be 500 watt capacity with 120 volt single phase, 60 Hz, 28 inches long with wall mounted thermostatic control and shall be Chromalox Model BB-H-21 with thermostat kit BBT-K-5 or approved equal.

2-2 HORIZONTAL UNIT HEATERS: Horizontal unit heaters with 7.5 KW capacity with 240 volt, three phase 60 Hz heating coils and 240 volt, single phase fan motor with 670 cfm capacity. Unit shall be supplied with wall mounting bracket and remote mounted thermostatic control. The unit shall be Chromalox Model LUH 07-05 with LUH-TK1 thermostat kit, or approved equal.

2-3 WALL MOUNTED ELECTRIC UNIT HEATERS: Two wall mounted electrical unit heaters with 4 KW with 240 volt, single phase, 60 Hz electric service. The unit shall be equipped with an integral thermostatic control and a separate disconnect switch. The fan shall have a capacity of 170 cfm. A surface mount wall box shall be provided. The units shall be Chromalox Model RSF 440 or approved equal.

PART 3: EXECUTION

The units shall be installed where shown on the drawings according to the manufacturer's written instructions and in compliance to all pertaining codes.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section of work consists of furnishing and installing a complete metering, telemetering, and plant control system. Complete system shall be furnished by one manufacturer, responsible for complete and proper operations as outlined. This system shall be factory assembled and tested prior to shipment and be the product of a manufacturer of proven experience, supplying similar systems in the fuel storage or water treatment industry, as applicable.

It is the intent of these specifications to acquire a complete system of control, instrumentation and alarm, to be furnished, installed, adjusted, tested and placed in satisfactory operation for the Government. A general description of the functions to be accomplished is given in these specifications. This description is not intended to itemize or list all of the necessary components. It is the responsibility of the Contractor to determine the exact items required to perform the functions as outlined and described, and to furnish and install same.

Components of the system shall be intrinsically safe for hazardous liquids, including Class I, Division I. Cables shall be 3-conductor, foil shielded, plastic covered and resistant to petroleum hydrocarbons and be suitable for direct burial.

1-2 The instrumentation panels and cabinets shall be factory assembled and wired with all internal circuitry completed, ready for field use, with only field connections for the cabinet terminals required. All terminals shall be appropriately labeled and suitable circuitry diagrams supplied with each panel or cabinet requiring field connections. All circuitry shall be tested and certified by the manufacturer to be functional prior to shipment. All electrical wiring shall conform to National Electrical Codes and to the applicable State and Local requirements. Any additional cost resulting from corrections of any deviation from codes or local requirements shall be done at no additional cost to the Government. Instrument transmitters shall respond to the measured variables without placing any delays of even a momentary nature on the primary measuring device or resisting its movement without the normal range of operation. Any instrument or circuit exposed to weather, condensate, or adverse environmental conditions shall be housed in appropriate protective enclosures or manufactured to weatherproof standards and Class I, Division 1, hazardous, where required. Any equipment which is exposed to low temperatures shall have an adequate thermostatically regulated temperature control. All equipment shall be able to withstand moth balling from October 30 to May 1 each year.

1-3 Meters, instruments, controls, etc., shall be by the same manufacturer in the appropriate system. If not the same, supplier shall submit a list of those items of other manufacturer's equipment with interfacing layout, and at least 10 installations more than one year old of similar equipment for evaluation prior to bidding. Contractors will be advised before award of contract on the suppliers that are acceptable.

1-4 RELATED WORK SPECIFIED ELSEWHERE: General Electrical Provisions - Section 16010; Basic Materials and Methods - Section 16100; Valves, Cocks, and Faucets - Section 15100.

1-5 SCHEMATICS: Provide schematic electric ladder diagrams and wiring diagrams to show that the systems operate as specified herein.

1-6 QUALITY ASSURANCE: References - National Electrical Code (NEC); National Fire Protection Association; American Water Works Association (AWWA).

1-7 PLANT CONTROL FUNCTIONS:

ROCK HARBOR WATER SYSTEM - IMPROVEMENT D

The following functions shall be achieved by use of standard available controls and equipment.

A. Central Start/Stop Controls for Normal Plant Operation:

Start Button Activates Following:

1. Starts raw water pumps (Pumps No. 1 and No. 2). Raw water pumps equipped with automatic alternator.

2. Starts agitator and drive at solids contact unit.

3. Starts transfer pumps (Pumps No. 3 and No. 4).

4. Starts all chemical mixers and feed pumps, except 20 gpd chlorine feed pump.

B. Manual Stop Button Activates Following:

Stops all of the above immediately with the exception of time delayed stop for the transfer pumps (Pumps No. 3 and No. 4). Time delay to be adjustable 0-15 minutes.

C. Automatic Stop:

When storage tanks (No. 1 and No. 2) are full, high water level control automatically stops plant as described above.

D. Start/stop controls for each filter (Filter No. 1 and No. 2) for normal backwashing operation. (Note: Filter controls shall be such that both filters cannot be backwashed simultaneously.)

1. Backwash start activates following (see sheet 2 of drawings for valve identification):

a. Valve A (backwash drain) opens

b. Valve B (surface wash) opens

c. Transfer Pumps (Pumps No. 3 or No. 4) stop and Valve D closes.

d. Backwash Supply Pump (Pump No. 5) starts after delay. Time delay adjustable from 0-5 minutes

e. Valve C (backwash supply) begins to open when Pump No. 5 starts. Time to completely open valve is 3 minutes.

Note: If the low water level is reached in the water storage tanks (Tank No. 1 or No. 2), none of the above operations will start and the control alarm shall be activated.

2. Backwash Stop Activates the following:

a. Closing operation of Valve C (backwash supply) begins. Time required for closing is 3 minutes.

b. Backwash supply pump (Pump No. 5) stops after delay. Time delay adjustable from 0-5 minutes.

c. Valves (backwash drain) and B (surface wash) close when Pump No. 5 stops (backwash supply pump).

d. Transfer Pumps (Pump No. 3 or No. 4) starts and Valve D opens when Pump No. 5 (backwash supply) stops.

Note: Time required to close/open Valves A and B shall be standard no greater than 30 seconds.

E. Sludge Blowdown Valve shall consist of the following controls:

1. The operator shall be an electric motor with a timer control. The time to close/open the valve shall be no greater than 30 seconds. The time controller shall have two adjustable selectors:

a. Hour selector: This selector will have a range of 0 to 24 hours at 1 hour intervals, and will allow for the selection of the hour in a day in which the valve will open.

b. Operation Time Selector: This selector will have a range of 0-60 minutes at 1 minute intervals, and will allow for the selection of the time elapsed between valve open and valve closed.

F. Backwash Waste System Controls: Backwash waste pumps (Pumps No. 8 and No. 9) will automatically start and stop by means of level control switches located at the backwash waste tank. The pumps shall be equipped with an automatic alternator (lead-lag operation).

The pumps shall automatically stop when the water level in the backwash waste tank reaches the pump off or the redundant stop Level. A central alarm shall be activated when the redundant stop level or the high water level is reached. A single pump shall start when the one pump level is reached and both pumps shall start when the dual pump level is reached. If the lead pump was inoperable, the lag pump shall start when the dual pump level is reached.

G. Additional Chemical System Controls:

1. The 20 gpd chlorine feed pump and associated solution tank mixer shall start when the high service pumps (Pumps No. 6 and No. 7) start. When the high service pumps stop, the 20 gpd chlorine feed pump shall also stop and the solution tank mixer will also stop, except in the case where the mixer was activated by the central plant start switch.

H. Alarms and Plant Shut-Down Switches:

1. Immediately following the influent flow meter and throttling valve, a flow switch shall be installed for the purpose of activating the central plant stop switch and the central alarm when no flow is registered at a time when the central plant start switch is in operation. A no flow condition would indicate that the raw water supply system is not in operation.

2. A switch at the solids contact unit agitator shall activate a central alarm and the central plant stop switch when the agitator is inoperable at a time when the central plant start switch is in operation.

3. Both of the filters (No. 1 and No. 2) shall be equipped with high water level (located 3" from top of tank) and low water level (located 6" below top of backwash waste trough) switches which will activate a central alarm and the central plant stop switch when either of these levels are reached at a time when the central plant start switch is in operation.

4. The 20 gpd chlorine feed pump shall be equipped with a switch which will activate a central alarm when this pump is inoperable at a time when the high service pumps (Pumps No. 6 and No. 7) are in operation.

5. The 65 gpd chlorine and alum feed pumps shall each be equipped with a switch which will activate a central alarm and the central plant stop switch if either of these pumps are inoperable at a time when the central plant start switch is in operation.

6. At the primary electric service line for the water treatment plant a battery operated light and horn alarm shall be installed. The battery shall be 12 volt DC type (guaranteed for 48 months). The alarm shall be activated 30 seconds after a power failure has occurred.

1-8 SUBMITTALS: In accordance with Section 01300, submit complete shop drawings detailing the system to be installed. Contracting Officer will indicate approval or disapproval of the shop drawings and, if not approved as submitted, will indicate the reasons therefore. Any work done prior to such approval shall be at the Contractor's risk.

PART 2: MATERIALS

2-1 MOTT ISLAND FUEL STORAGE - IMPROVEMENT B AND ROCK HARBOR FUEL STORAGE - IMPROVEMENT C: Tank level measurement system shall consist of a capacitance type probe and transmitter with solid state modular construction for control and receiver unit. The level measuring probe shall have sufficient number of extensions to provide complete range measurement for each tank.

A. Oil Resistant Cable: Oil resistant, foil shielded, 3-conductor cable, of 16 gauge size shall be used to connect the level probes at the storage tanks to the display panel and alarms for that length of cable from the storage tanks to a minimum distance of 100 feet from the secondary containment wall.

B. Standard Cable: Foil shielded, 3-conductor cable of 16 gauge size shall be used to connect the level probes at the storage tanks to the display panel and alarms for that length of cable starting from the point where the oil resistant cable terminates and extending to the display panel and alarms. This cable shall be for direct burial.

C. Alarm Horn: The alarm horn shall be weatherproof type with a sound level of not less than 100 d.b. (A scale), for 120 volt a.c., 60 Hz. A silence button shall be provided. A light shall remain on until the problem is rectified.

D. Panel Mounted Meters: The panel mounted meters shall have a scale length of 7-1/2 inches with 0-100% reading. Meter shall be Amiprodux Model M/190 Panel-Meter, or approved equal.

E. Single Tank Level Central Units: A solid state electronic device with M-module for receiving the transmitted signal from the level probe and displaying it continuously on an M/190 Panel-Meter. The central unit shall be Amiprodux K1 Central Unit or approved equal.

F. Dual Tank Level Central Unit: A solid state electronic device with 2 M-modules and capability for two additional units for receiving the transmitted signal from the level probes and displaying it continuously on an M/190 Panel-Meter. The dual central unit shall be Amiprodux K4 Central Unit with two M-modules or approved equal.

G. Selector Switches: Two position with sufficient poles as required.

H. Level Probes and Transmitters: The level probes shall be plain steel with teflon covered measuring elements. The measuring element shall be mounted in one-inch steel pipe. The unit shall be intrinsically safe for use in hazardous locations. The level probes and transmitters shall be Amiprodux, Model PA Pipe-Type Probe with transmitter.

I. High level detector and valve relay control unit (for day tanks) shall have two relay functions at the control level (rising). The control unit includes an RY (upper level) solid-state plug-in module, and 2 relays (e.g. for operating light and closing valve). One relay shall have reset with reset button (e.g. to silence alarm, leaving signal light on). The control unit shall be Amiprodux Set 210 Control Unit or approved equal. Control probe, intrinsically safe for hazardous liquids (including Class I, Division I), made of nickel-plated brass, with transmitter and integral oil-resistant 3-lead cable 16 ft. long. Probe cable circuit to be intrinsically safe in hazardous areas (including Class I, Division I);no conduit needed. The control probe shall be Amiprodux Set/Ts Universal Control Probe or approved equal.

J. High level detector, valve relay control unit and alarms system for bulk fuel storage tanks shall have a solid-state electronic capacitance type sensor probe system with modular solid state electronics central controller and shall be provided to alarm the high level when filling the bulk fuel storage tank and cause the appropriate valves to close to prevent overfilling of the tanks. The system shall be intrinsically safe for use in hazardous locatons as hydrocarbon fuel tanks. The system shall be self-checking with alarms if system malfunctions and shall be fail-safe by preventing valves opening or pumps starting. The system shall be Amiprodux Lev-trol for 1 or 2 tanks as required.

K. Pedestal Mounted Control Centers: A weatherproof pedestal mounted enclosure shall be provided to contain the tank level indicators and the high level control system. The enclosures shall be equipped with a heavy duty hardened steel hasp and padlock key to the NPS requirements. A pedestal shall be provided at each fuel loading station.

L. Pressure Switch: A hermetically sealed pressure control with Division II explosion-proof pressure control. The controller housing shall be multi-chambered cast aluminum, fully gasketed. The pressure range shall be adjustable from 10 to 100 psi with sensor being constructed of 347 stainless steel. Unit shall be proof tested to 150 psi. The unit shall be equipped with one SPDT switch rated at 11 amps, 125/250 VAC. The unit shall be United Electric Control Company NOVA Type H115CD Model 356 or approved equal.

2-2 HEADQUARTERS CONTROL PANEL CABINETRY, ROCK HARBOR SYSTEM - IMPROVEMENT D: Plant instrumentation as specified herein shall be mounted in a front access cabinet. Cabinet shall be rigid, reinforced 16 gauge minimum welded steel construction, and suitable for multiple gang display as plant size increases. No panel face mounting screws shall be visible from the front of the console. All accessory equipment shall be readily accessible for minimum ease of inspection and service. Access to the cabinetry shall be provided by a swinging hinged front door. This door shall be rigidly formed, as to eliminate diagonal twist or sagging while in the open position. The door shall be gasketed to eliminate dust when the cabinet is closed and have an approved locking device. The cabinet and framework shall be finished in baked enamel with a charcoal grey. All equipment placed in the above described cabinetry shall be prewired and electrically complete.

2-3 NAMEPLATES AND GRAPHIC DISPLAYS, ROCK HARBOR SYSTEM - IMPROVEMENT D: Each major element of the system located within the headquarters cabinetry shall be identified by a nameplate. Nameplates include, but are not limited to, relays, time display assemblies, control assembly switches and variable adjustments. Each light, switch, instrument and so forth, mounted on the face panel of the headquarters cabinetry, shall have readily visible and permanent identification. Nameplates shall be fabricated from durable material in which the identifying letters, numbers and names shall be engraved. The identifying lettering for all face panels shall be approved by the Contracting Officer prior to fabrication.

2-4 GENERAL - INSTRUMENTS AND PERFORMANCE, ROCK HARBOR WATER SYSTEM - IMPROVEMENT D:

A. All instruments shall be two or three wired electronic type, powered by 115 volt, 60 Hertz, AC current, have simplified printed circuits, fully transistorized, completely solid state plug-in components that are interchangeable with those of other similar instruments and be connected to a test plug for testing and calibrating purposes, except as shown on the drawing.

All recording instruments shall have stainless steel, or other non-corrodible material for all moving components, a direct reading indicator strip, electric proportional hand and automatic reset modes; and a capillary tube type ink cartridge that holds at least a 60 day supply of ink. A one year supply of recording sheets and ink shall be supplied for each instrument.

All instruments having a controlling function, such as for automatic operation of chemical feed systems shall produce that output signal required to actuate the equipment being controlled.

Each instrument shall be housed in a dust and moisture-proof enclosure of sturdy non-corrodible materials such as stainless steel, have terminal strip or suitable for #12 wire and be mounted on roller guides with safety stops for partial withdrawal without interruption of function for testing and servicing. Lighted indicators shall have dual lamps, linear line switch-lights, and test plug for lamp and circuit tests.

B. The performance accuracy, within the temperature limits from 40 degrees to 120 degrees Fahrenheit, shall be within ± 0.5 percent of scale span, have a dead band of less than ± 0.2 percent of span, repeatability of ± 0.2 percent of span and readout accuracy of ± 1 percent of scale.

2-5 MULTIPLE ALARM INDICATOR, ROCK HARBOR WATER SYSTEM - IMPROVEMENT D: Multiple alarm indicator(s) shall be mounted in the headquarters control cabinetry. Alarm shall be presented in the form of lights on the face of the module with each having its annunciated function. Whenever an alarm occurs, the associated light shall light up on the cabinet, and simultaneously signal the remote horn and light outside the bulding.

2-6 COMMON AUDIBLE MODULE, ROCK HARBOR WATER SYSTEM - IMPROVEMENT D: When any alarm in the system occurs, the light shall flash and an audible annunciator within the module shall be energized. All incoming alarm conditions shall operate independently so that the tone annunciator is locked out only by those alarms which have already been silenced. An alarm silence button shall be provided.

2-7 EMERGENCY POWER ALARM, ROCK HARBOR WATER SYSTEM IMPROVEMENT D: A battery powered audio and light alarm shall be supplied to monitor the water plant power supply. The battery powered alarm shall float on the system to maintain batteries at full charge. When a power failure occurs at the Water Treatment Plant and lasts longer than 30 seconds the alarm shall sound with a horn and a blue light shall flash. The flashing light and horn shall be located as instructed by the Contracting Officer. An alarm silence button shall be provided. A disconnect shall be provided for de-activation during winter shut-down.

Battery charger unit shall incorporate an SCR high charge control and transistor float control, each control contained within one or more feedback loops. The electronics assembly shall be completely encapsulated and suffer no damage when short circuited or connected to the battery in opposite polarity. Battery shall be completely recharged within 12 hours after use. The high charge light operation shall also indicate proper operation of the entire charging system. Battery maintenance shall not be required more than once in eight years and the charger shall be guaranteed a minimum of five years.

The emergency power alarm system shall be Standby Systems, Inc., Model No. SBL-1000-NC or approved equal, with a 12 volt nickel cadmium battery providing 1-1/2 hours of power for 600 watt service. The flashing light shall be a 12 volt beacon warning light with blue lens and a permanent mount, by Trippe Lighting Co., Model No. MV-2 or approved equal. The horn shall be rated 110 db or more, 12 volt dc, weatherproof, surface mounted horn manufactured by Simplex Recorder Co., or approved equal.

2-8 ELAPSED TIME METERS, ROCK HARBOR WATER SYSTEM - IMPROVEMENT D: Time running meters shall be located in the headquarters cabinetry for each individual pump with space for two future time run meters. The meters shall be actuated by report-back signals originating at the pump stations. Time running meters shall be equal to G.E. Type KT Model 8KT11BA2.

A. All pumps except the chemical feed pumps shall be equipped with elapsed time meters. If required extra contacts or step down transformers shall be provided to facilitate proper interconnection to the pump starters.

PART 3: EXECUTION

3-1 GENERAL: All work shall be performed in accordance with Division 16 and all appurtenant codes and requirements of NFPA, and National Electrical Code.

3-2 The installation of all controls, alarms, relays and wires shall be per the manufacturer's instructions.

3-3 The complete system including valves with motor operators or solenoids shall be completely tested and operational before any part of the system will be acceptable. Provide a complete operational test to demonstrate correct operation of all equipment to the satisfaction of the Contracting Officer and in his presence.

END